Indiana Department of Environmental Management

White River TMDL Study

June 26, 2003

Draft Report

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Executive Summary

The City of Indianapolis has collected water quality data from the West Fork White River in Marion County and south to Waverly since 1991. In 1998, the Indiana Department of Environmental Management (IDEM) determined that segments of the river in this area do not consistently comply with the state's water quality standards for the following parameters:

- Ammonia
- Cyanide
- Dissolved Oxygen
- *E. coli* bacteria

As a result, portions of the White River were put on the 1998 303(d) list and required to have a Total Maximum Daily Load (TMDL) evaluation for these constituents. Development of a TMDL was investigated for these four parameters. Results of these investigations are summarized for each parameter as follows:

Ammonia: During data analysis for this TMDL, it was determined that the data did not support a need for a TMDL on the White River for ammonia. A request by the City of Indianapolis to remove the West Fork of the White River for ammonia from the 303(d) list was reviewed and approved by IDEM. In IDEM's Summary Response to Comments, IDEM states, "IDEM re-evaluated these listings in light of the data submitted by the City of Indianapolis, Department of Public Works. IDEM will recommend that the West Fork of the White River from the confluence of Fall Creek to the confluence of Pleasant Run be delisted for ammonia." A check against the draft 2002 303(d) list verifies that the White River is not listed as impaired for ammonia.

Cyanide: Analysis indicates that the primary source of cyanide is the city's Advanced Wastewater Treatment plants (AWTs) at Belmont and Southport. The instream water quality monitoring data supports this finding. Hence, control of cyanide is addressed through the NPDES permit associated with the AWTs. Under IDEM listing methodologies, the White River segments should be listed as a Category 4b, not as a Category 5 for cyanide. Category 4b is for "Waterbodies Where Other Pollution Control Measures Could Result in Attainment of the Water Quality Standards" and a TMDL does not need to be completed. As a result, a TMDL evaluation was not required or performed for this pollutant.

Dissolved Oxygen: Low dissolved oxygen, which can violate the instream water quality standard, was determined to be caused by combined sewer overflow (CSO) discharges. The city's CSO Long Term Control Plan (LTCP) is being developed to reduce or eliminate the occurrence of low dissolved oxygen. Under IDEM listing methodologies, the White River segments should be listed as a Category 4b, not as a Category 5 for dissolved oxygen. Category 4b is for "Waterbodies Where Other Pollution Control Measures could Result in Attainment of the Water Quality

Standards" and a TMDL does not need to be completed. Additional TMDL evaluation was therefore not performed for this parameter.

***E. coli* bacteria**: *E. coli* bacteria standards of 125 colony forming units (cfu)/100 ml (geometric mean of five samples collected over 30 days) and 235 cfu/100 ml (maximum day value) are often exceeded on the river. A model of the White River was developed and calibrated to the existing instream data for *E. coli* bacteria. A ten-year period of time was simulated to predict resultant instream *E. coli* bacteria counts for each day of the simulation period. Data collected by several agencies was obtained for the model development.

The White River was divided into three segments for analysis purposes:

- White River North -- Upstream Marion County line to Lake Indy
- White River CSO -- Lake Indy to Tibbs/Banta Landfill
- White River South -- Tibbs/Banta Landfill to Waverly

Sources of *E. coli* in the watershed include CSOs, urban stormwater, failing septic systems, and pollutants from wildlife and domestic animals. Point sources and nonpoint sources were characterized and represented in the model for evaluation of loadings and development of load reduction scenarios to determine the required action necessary to attain water quality standards. Based on the modeling, the allowable TMDLs for White River were determined to be as follows:

- White River North -- **1.04×10^{12} cfu**, which requires an 82% reduction in the average daily bacteria load.
- White River within the CSO area -- **1.20×10^{12} cfu**, which requires a 99.7% required reduction in the average daily bacteria load.
- White River South --**1.49×10^{12} cfu**, which requires a 99.7% reduction in the average daily bacteria load.

The modeling analysis also incorporated a representative load reduction scenario. This scenario is representative of the current and future watershed programs being pursued by the City of Indianapolis. This program consists of removing illicit sanitary connections, converting failing septic systems to sanitary sewers in the Barrett Law Program, reducing stormwater load per the NPDES Permit Program, and controlling CSOs per the Final CSO LTCP[1]. The city's current stormwater NPDES Permit program is assumed to reduce the stormwater *E. coli* bacteria load by 10 percent. The performance of the city's projected programs was compared with the

[1] The modeled load reduction was the recommended plan in the April 2001 Draft CSO LTCP. The recommended level of CSO control was 85% capture, or 12 overflow events per year. The final CSO LTCP is in development.

TMDL monthly geometric mean standard of 125 cfu/100 ml, percent of days with *E. coli* bacteria levels above the daily maximum standard of 235 cfu/100 ml, and the number of days per year with *E. coli* bacteria levels above 10,000 cfu/100 ml. The findings show that all three targets can be met under dry weather flow conditions upstream and within the CSO area by the removal of failing septic systems and illicit sanitary connections. The findings also show that significant reductions in wet weather *E. coli* bacteria can be achieved by stormwater and CSO controls. However, additional load reduction may be necessary to achieve the TMDL.

Section 1
Introduction

The State of Indiana assesses its water bodies for compliance with water quality standards criteria established for their designated uses as required by the Federal Clean Water Act (CWA). Assessed water bodies are placed into three categories depending on water quality assessment results: supporting, partially supporting, or not supporting their designated uses. These water bodies are found on Indiana's 305(b) list, which is published every two years, as required by the section of the CWA that defines the assessment process.

Some of the 305(b) partially and not supporting water bodies are also assigned to Indiana's 303(d) list, also named after a section of the CWA. Water bodies on the 303(d) list are required to have a TMDL evaluation for the water quality constituent(s) in violation of the water quality standard. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream water quality conditions. This allows water quality-based controls to be developed to reduce pollution and restore and maintain water quality.

In 1998, water quality data collected by the Indiana Department of Environmental Management (IDEM) in Marion County indicate that segments of the river do not comply with the following water quality standards:

- Ammonia
- Cyanide
- Dissolved Oxygen
- *E. coli* bacteria

As a result, segments of the White River in Marion County were added to the State's 1998 303(d) list and scheduled for a TMDL evaluation.

Water quality data collected documents the problem and was used to develop a TMDL for each of the parameters. Available data has been gathered from the City of Indianapolis Office of Environmental Services (OES), the Marion County Health Department (MCHD), and IDEM pertaining to the White River for use in performing a TMDL for the four parameters listed above. The following sections describe the White River study area, the parameters of concern, and the applicable water quality standards. A summary of the available data for each parameter from each source and weather condition, TMDL load analysis, public participation process, monitoring plan, and implementation activities and schedule is also given.

For purposes of this report, references to the White River are intended to mean specifically the West Fork of the White River.

Section 2
Background Information

The study area relevant for this TMDL report consists of the White River from the Marion County border upstream to Waverly at State Route 144 downstream and the area that drains into this segment of the White River.

2.1 Parameters of Concern

Section 303(d) for the state of Indiana updated in 1998 lists four parameters of concern for the White River within the study area described above:

- Ammonia
- Cyanide
- Dissolved Oxygen, and
- *E. coli* bacteria.

Section 303(d) of the Clean Water Act provides that states are to list waters for which technology-based limits alone do not ensure attainment of water quality standards. States are to list and set priority rankings for their listed impaired waters. To address water body segments on the 303(d) list, states are required to develop TMDLs that allow these segments to attain water quality standards. This report presents instream data as well as modeling results and future load allocations for these parameters.

2.2 Water Quality Standards

IDEM has promulgated water quality standards to protect designated uses of waterways. Each of the listed parameters (ammonia, cyanide, dissolved oxygen, and *E. coli* bacteria) has listed numeric values or a formula to calculate numeric values in the standards, which can be used as target values for the TMDL.

2.2.1 Ammonia

The State water quality standards have numeric limits on maximum ammonia concentrations and 24-hr average ammonia concentrations. The ammonia water quality standards are variable based on the stream temperature and pH.

2.2.2 Cyanide

The State's water quality standard has a total cyanide standard of 5.2 ug/L for Chronic Aquatic Criterion (CAC) and 22 ug/L for Acute Aquatic Criterion (AAC). The CAC is a 4-day average, whereas the AAC is a maximum.

2.2.3 Dissolved Oxygen

The applicable dissolved oxygen standard is as follows:

> *Concentrations of dissolved oxygen shall average at least five (5.0) milligrams per liter per calendar day and shall not be less than four (4.0) milligrams per liter at any time.*

2.2.4 Bacteria

The applicable bacteria standard is for *E. coli* and is as follows:

> *… for full body contact recreational uses E. coli bacteria, using membrane filter (MF) count, shall not exceed one hundred twenty-five (125) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.*

E. coli will be the water quality indicator and the target values are:

- Monthly geometric mean not to exceed 125 cfu/100 ml
- Monthly maximum not to exceed 235 cfu/100 ml.

Section 3
Data Sources and Initial Assessment

The Indiana water quality standards for dissolved oxygen, *E. coli* bacteria, and cyanide are being exceeded in the White River. At the beginning of this project, ammonia was also exceeding the standard as set by IDEM at that time. With an update to the ammonia standard adopted in 2002, this parameter no longer exceeds the standard, however, ammonia levels were part of the data set collected for this project.

Data were obtained for the White River from the upstream boundary of Marion County downstream to Waverly for use in performing a TMDL analysis. The extent of the study was extended to Waverly in order to assess the impacts from CSO and urban development on the White River downstream of Indianapolis. This section describes the sources of the data collected for review and gives an assessment of compliance for each parameter.

3.1 Data Sources

Data characterizing ammonia, cyanide, dissolved oxygen, and *E. coli* bacteria was obtained from the following sources:

- City of Indianapolis Department of Public Works Office of Environmental Services (OES),
- Marion County Health Department (MCHD), and
- Indiana Department of Environmental Management (IDEM).

3.2 Sampling Locations

Data for each parameter were collected at various intervals and locations by the three agencies. The sampling locations for each agency are shown on **Figure 3.1**.

OES has collected samples and performed analyses for all four parameters being reviewed at six locations on the White River. These sampling locations are:

- 82nd Street – This site is the same location as the IDEM 86th Street station
- Morris Street
- Harding Street
- Tibbs/Banta Landfill
- Southwestway Park
- Waverly and State Road 144

OES also installed continuous monitoring instrumentation in the White River and collected dissolved oxygen data in 15-minute intervals at three locations on the White River from June 2001 to December 2001. These sites are:

- 16th Street: 1998-present, except 2002, May/June – December

- Indianapolis Power and Light Dam: 1998-present, May/June - December
- Waverly and State Road 144: 1998-present, May/June - December

MCHD collected samples and performed analysis for *E. coli* bacteria at eight locations and dissolved oxygen at nine locations on the White River. All locations were sampled from April to October each year. All sites were sampled monthly, with the exception of the New York Street location, which was sampled five times per month. The locations along with their beginning and ending sampling dates are as follows:

- 96th Street – April 2000 to October 2001
- Marina Drive – April 1998 to October 2001
- Ruth Drive – April 1998 to October 2001
- Howland at Crittenden – April 1998 to October 2001 (dissolved oxygen only)
- Broad Ripple Park ramp – April 1998 to October 2001
- 6800 Cornell Avenue – April 1998 to October 2001
- Lake Indy - June 1996 to October 2001
- New York Street – May 2001 to present
- Raymond Street – June 1996 to October 2001

IDEM collected dissolved oxygen data at thirteen sites on the White River. The site locations and frequency of sampling are as follows for two sites located inside and one site located outside of Marion County:

- 86th Street in Nora – Monthly from March 1991 to present and Weekly from March 2001 to July 2001. This site is the same as the OES 82nd Street station.
- Raymond Street - Weekly from March 2001 to July 2001
- Waverly and State Road 144 – Monthly from April 1991 to present

The other ten sites of the thirteen locations that were used by IDEM were located within Marion County. These sites had limited sampling. The location and frequency of sampling for these sites are:

- 37 feet from right bank and on left bank in line with yellow and brown building next to water tower, downstream of confluence with Big Eagle Creek, upstream of confluence with Lick Creek – Sampled July 22, 2000
- Approximately 100 feet downstream of Stout Dam on east bank – Sampled July 25, 2000
- Under power lines above Harding Street – Sampled July 27, 2000
- Under power lines, across from and opposite bank of Belmont AWT Plant effluent outfall – Sampled July 27, 2000 and August 8, 2000
- Belmont AWT Plant Effluent Outfall – Sampled July 27, 2000 and August 8, 2000

- Adjacent to Water Tower, 75 feet from right bank, downstream of confluence with Big Eagle Creek, upstream of confluence with Lick Creek – Sampled July 27, 2000
- Over old sheet piling, 162 feet from USGS Gage station, 38 feet from bank – Sampled July 27, 2000
- 160 feet from right bank, 1000 feet from conveyor building, 500 feet downstream from gage, downstream of confluence with Big Eagle Creek, upstream of confluence with Lick Creek – Sampled July 27, 2000
- Near west bank, adjacent to Indianapolis Power & Light water tower – Sampled July 27, 2000
- 210 feet from south corner of intake control building, 200 feet from north corner of building, downstream of confluence with Big Eagle Creek, upstream of confluence with Lick Creek – Sampled July 27, 2000

3.3 Data Review and Initial Findings

CDM has reviewed the available data for use in performing a TMDL for *E. coli* bacteria. All data collected by OES, MCHD, and IDEM are considered to have received quality assurance checks by the respective collecting entity (OES, MCHD, or IDEM). In addition, IDEM has approved the use of OES and MCHD data for this analysis. Additional data checking was not performed as part of this project. Data flagged by the collecting entity as questionable are presented in the attached graphs and noted as being questionable, but they have not been used for determination of compliance.

All accepted data are considered comparable. OES and TMDL sampling (April 2002-October 2002) used the same method for comparison purposes. That is, where data is collected by more than one entity at a particular monitoring location, the data sets are combined for the assessment of compliance with the applicable standard.

The data obtained from the various sources and locations was evaluated for compliance with the Indiana surface water quality standards as set in the Indiana Administrative Code (327 IAC 2-1-6) for each parameter. The following subsections summarize the findings for each parameter reviewed.

3.3.1 Ammonia

Ammonia data for January 2000 to December 2001 available from the OES was reviewed. Currently, the State of Indiana uses water quality standards developed for ammonia by EPA in 1998. The data obtained for this parameter are provided in Appendix A in table and graphical form. The plots are in order from upstream to downstream locations. Review of this data indicates that for the past two years (2000 and 2001), the stream consistently met the Indiana standard (1998 EPA Standard) for

ammonia, as summarized in **Figures 3.2 through 3.5**. IDEM has not included ammonia on the 2002 proposed 303(d) listings for the White River in Indianapolis.

3.3.2 Cyanide

Quarterly cyanide data obtained from the City of Indianapolis OES and IDEM for the period of March 2000 to November 2001 was reviewed. **Figures 3.6 through 3.9** present the information graphically. The current Indiana surface water quality standard for total cyanide for the chronic aquatic criterion (CAC) is 5.2 ug/L (327 IAC 2-1-6 Table 1). The data obtained for this parameter are provided in **Appendix A** in table and graphical form. The plots are in order from upstream to downstream locations. Cyanide exceedances in the White River appear to be stemmed from discharges from the Belmont and Southport AWT plants. This initial assessment is supported by the data for the Tibbs/Banta Landfill, Southwestway Park, and Waverly (SR 144) sampling stations. The data at these stations show a number of exceedances while data upstream of these stations and both AWT plants shows only one cyanide exceedance (at the 86th Street site), as shown in Figure 3.6.

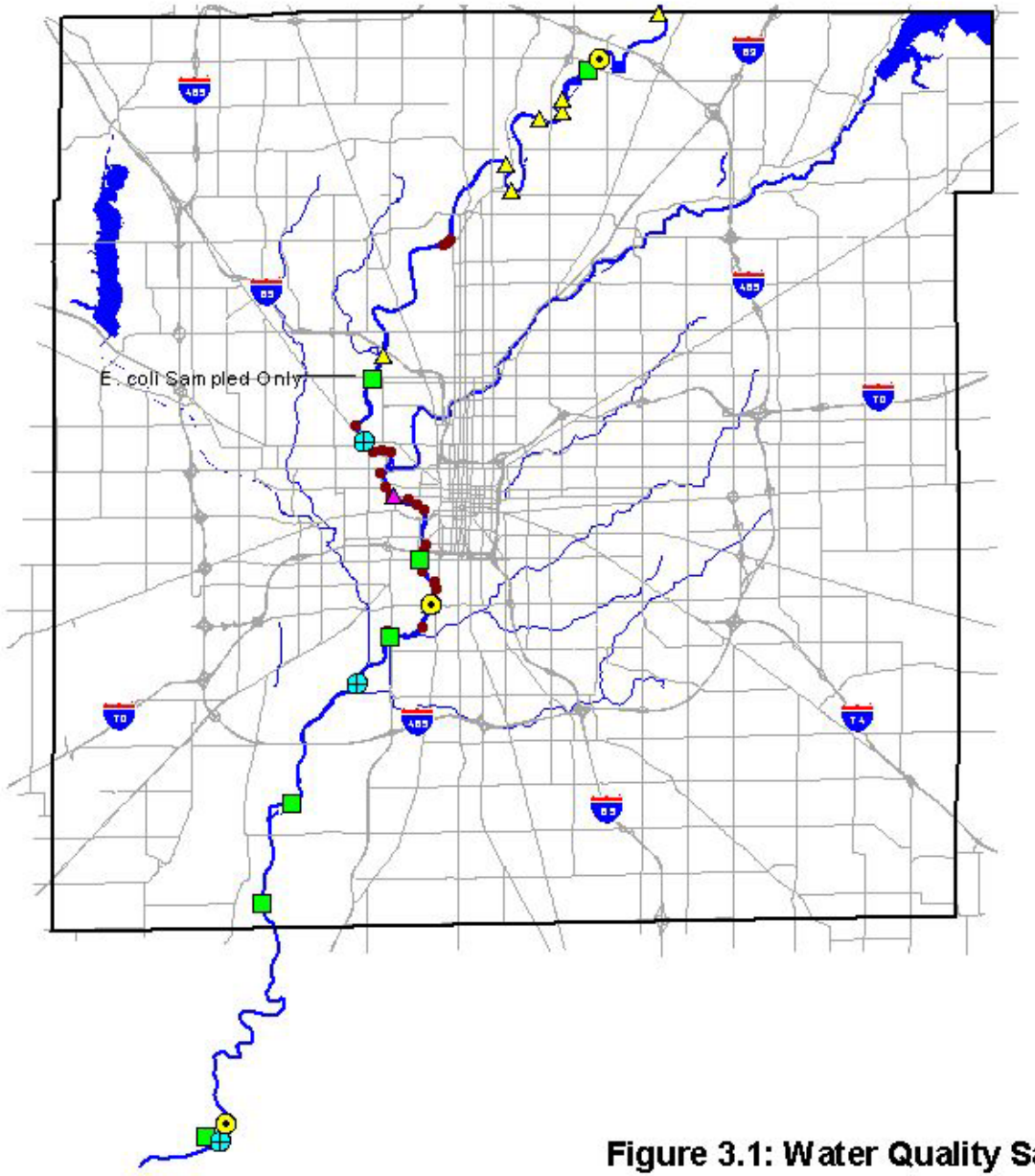
3.3.3 Dissolved Oxygen

Dissolved oxygen (DO) data has been collected at 15 locations on the White River at varying intervals ranging from monthly to weekly from January 2000 to December 2001. The data for 14 stations out of 15 showed one hundred percent compliance with the Indiana DO standard of 4 mg/L minimum and 5 mg/L average per day. The one exception was at the New York Street station, where there was one occurrence of being below the standard of 4 mg/L. **Figures 3.10 though 3.17** and **Figure 3.20** present this information graphically.

In addition to the grab samples, OES also deployed continuous dissolved oxygen and temperature probes at three locations on the White River: 16th Street, Indianapolis Power and Light (IPL), and Waverly (SR 144) for June to December, from 1998 to present, except for the year 2000 on 16th Street. Compliance with the minimum value of 4 mg/L for DO was 100% at the 16th Street and IPL monitoring stations, where it was only 96% of the time for the Waverly (SR 144) station. Compliance with the daily average of 5 mg/L was 100% at 16th Street, 99.3% at IPL, and 98.7% at Waverly (SR 144). **Figures 3.18** and **3.19** present this information graphically.

3.3.3 *E. coli* Bacteria

Monthly *E. coli* bacteria sampling data for January 2000 to December 2001 was analyzed from OES, MCHD, and IDEM. The percent compliance of *E. coli* generally decreases when moving from the upstream boundary at 96th Street (64%) to the downstream boundary at Waverly (21%) for the maximum monthly value of 235 cfu/100 ml standard. Only the New York Street sampling location has sufficient sampling frequency (5 samples in 30 days) for a geometric mean comparison. That station never achieved compliance with the geometric mean monthly standard of 125 cfu/100 ml during 2001. **Figures 3.10 through 3.18** present this information graphically.



LEGEND

- CSO
- MCHD Sampling Locations - Sampled Monthly
- MCHD Sampling Locations - Sampled 5 times per month
- OES Sampling Sites - Sampled Monthly
- OES Continuous DO Sampling Sites
- IDEM Sampling Locations - Sampled Monthly and Weekly from March 2001 to July 2001
- Waterway
- Major Roadway

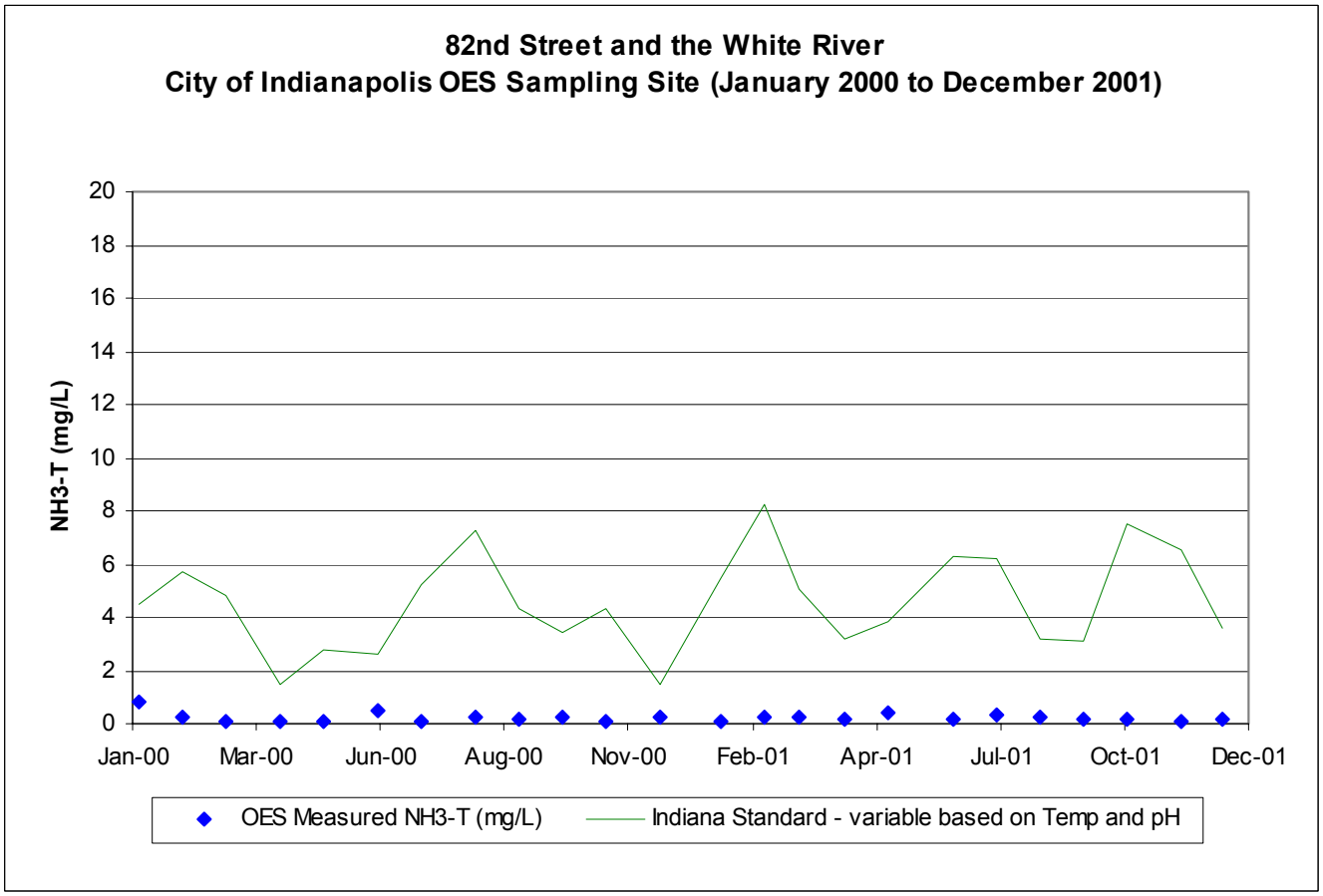
N W E S

5 0 5 10 Miles

Figure 3.1: Water Quality Sampling Sites on the White River City of Indianapolis

As of Spring 2002

Figure 3.2: White River Ammonia Data



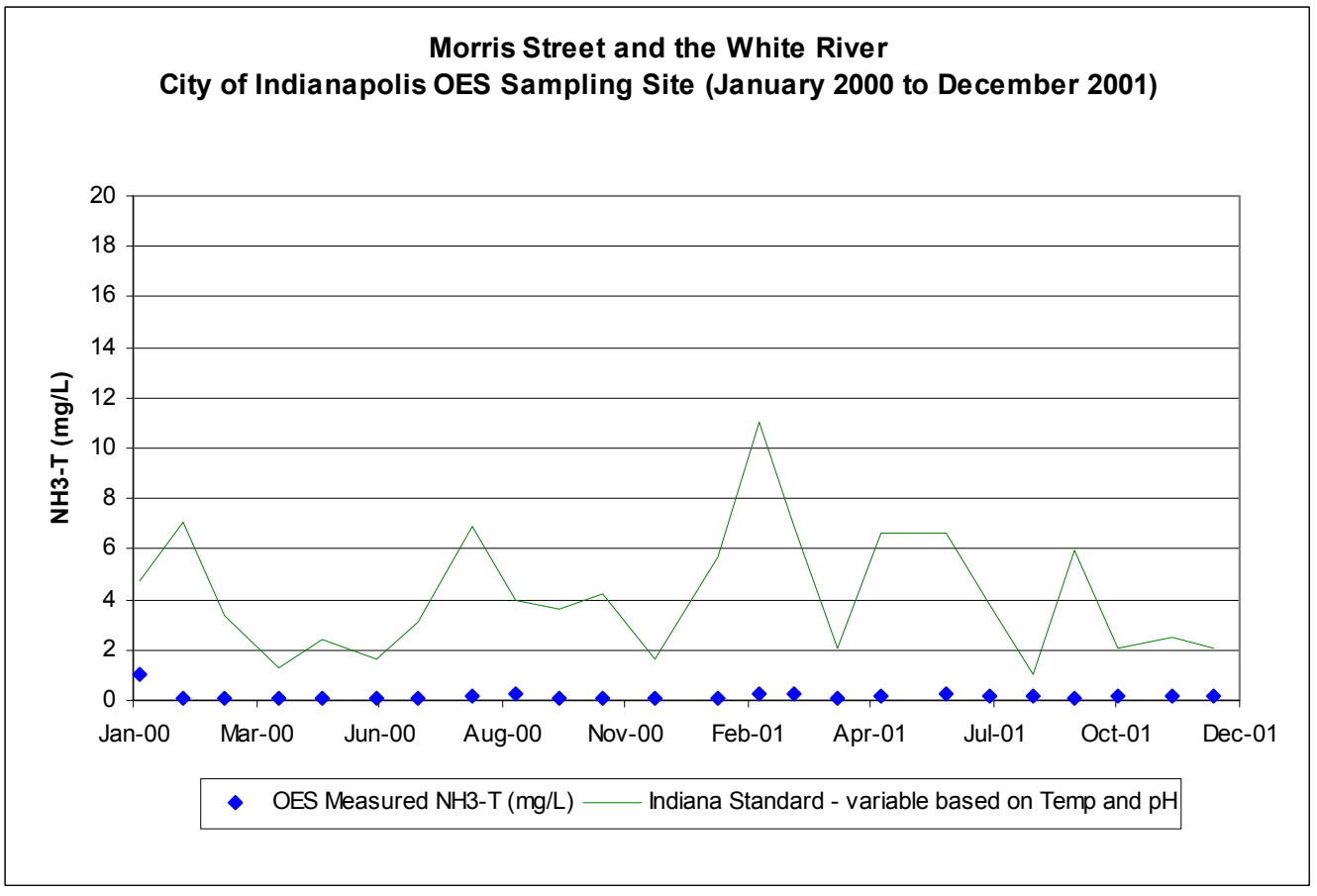
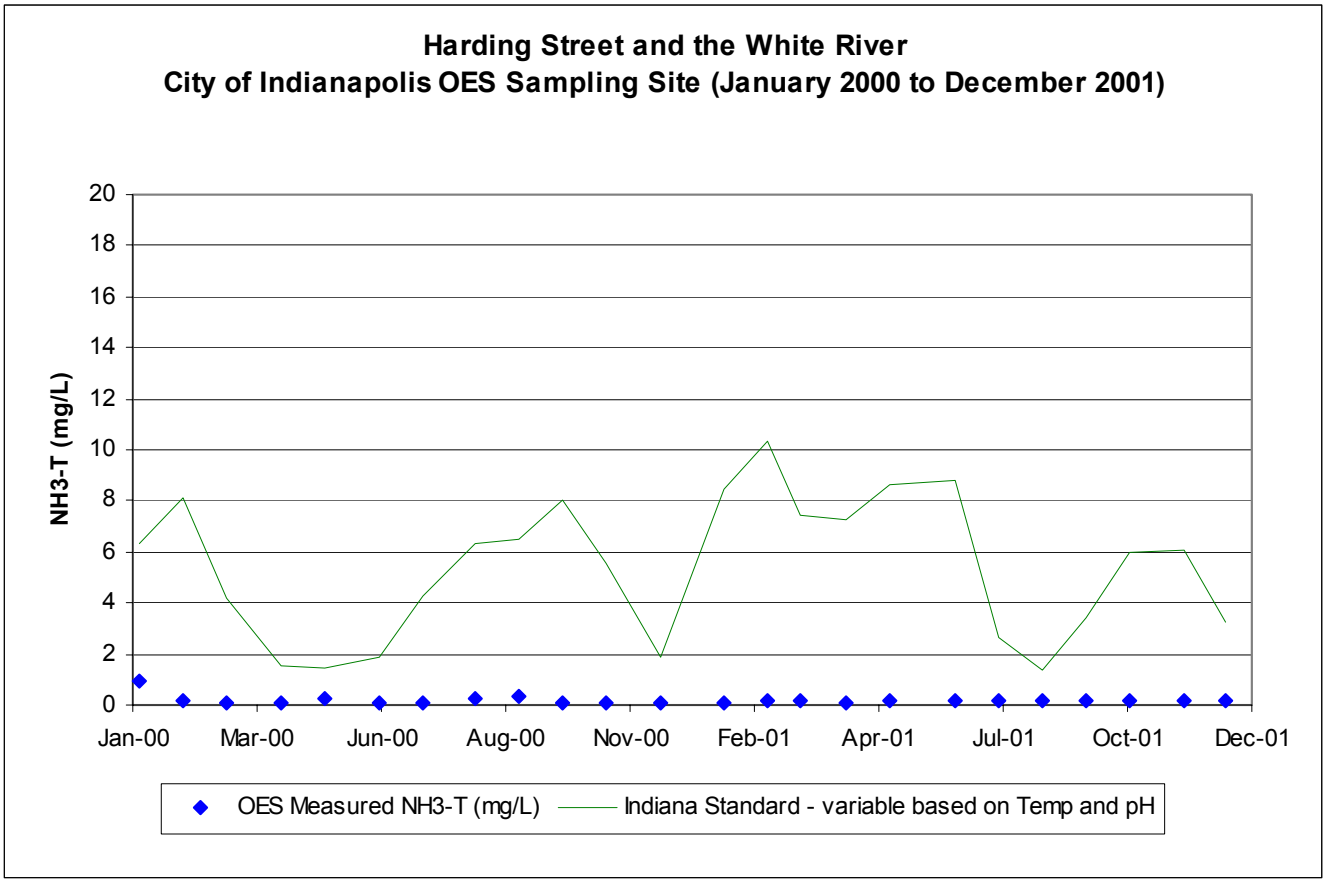


Figure 3.3: White River Ammonia Data



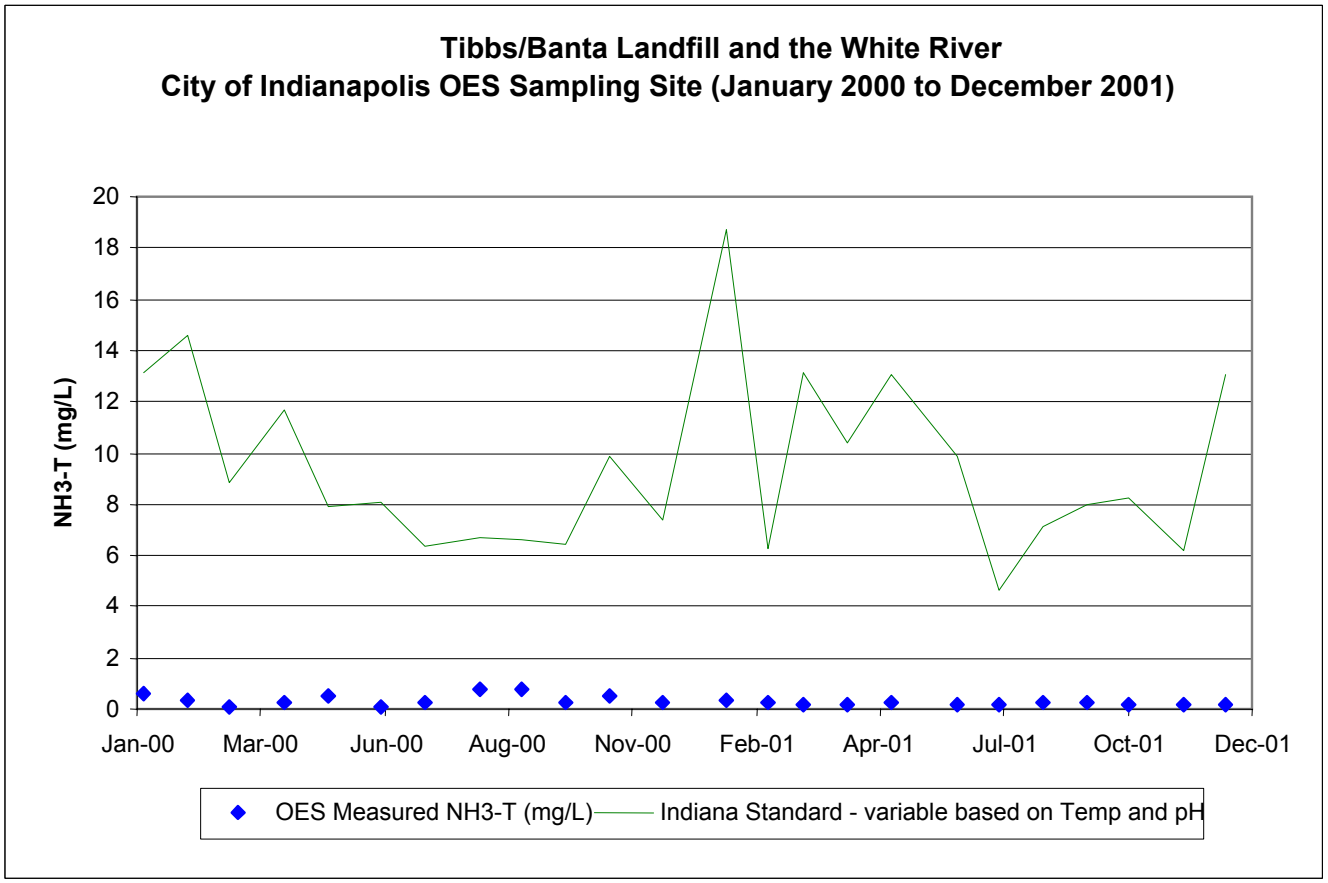
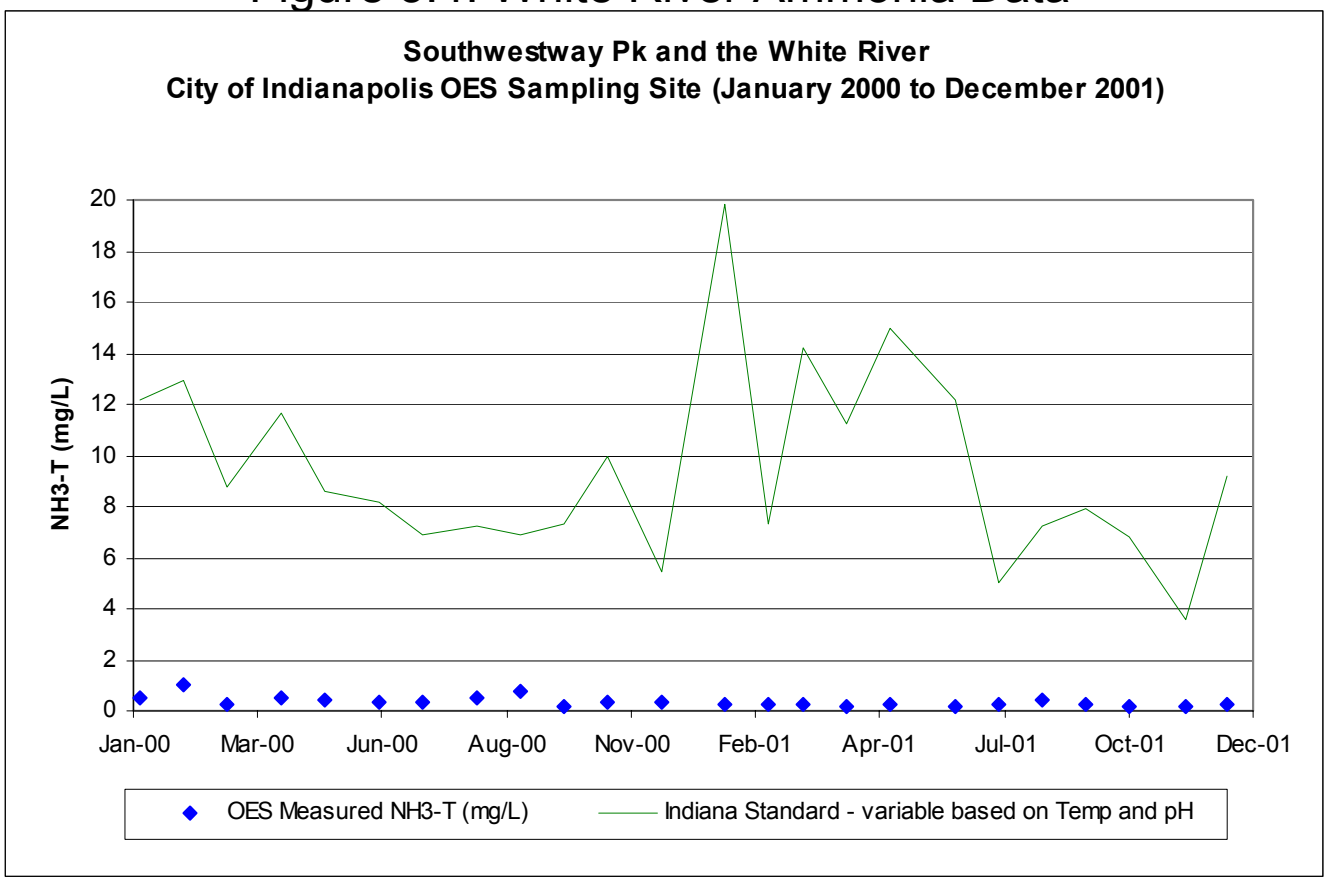


Figure 3.4: White River Ammonia Data



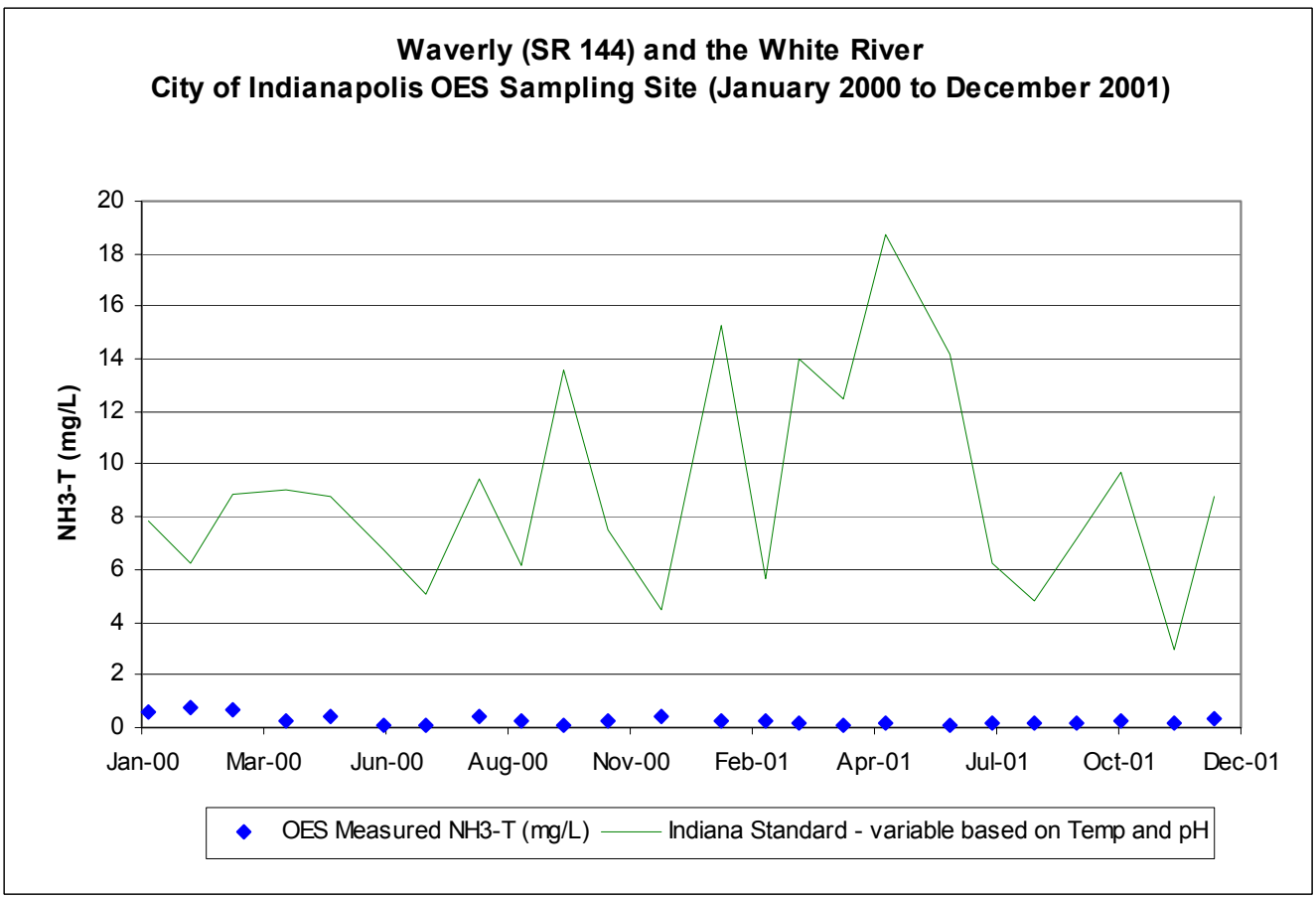


Figure 3.5: White River Ammonia Data

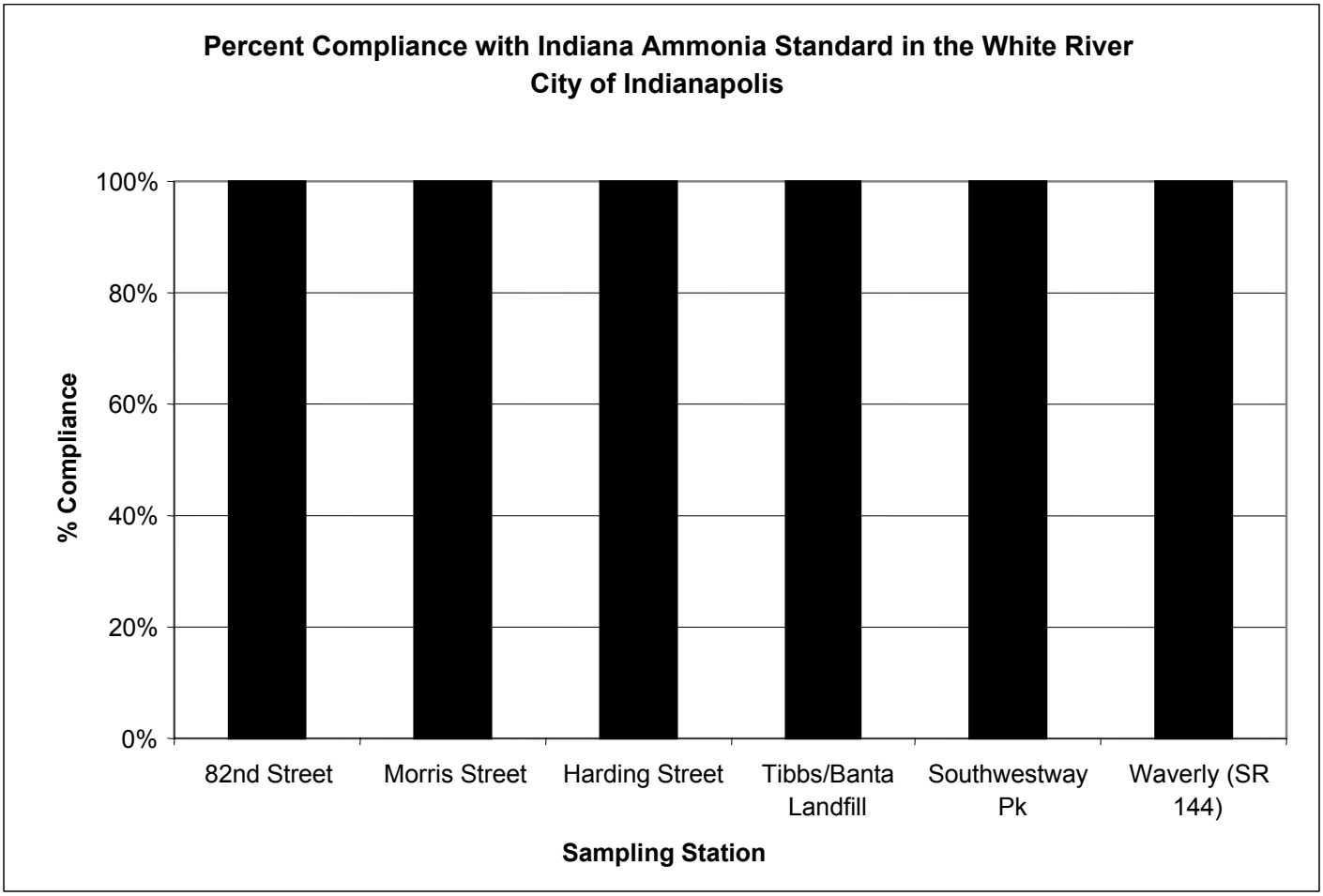
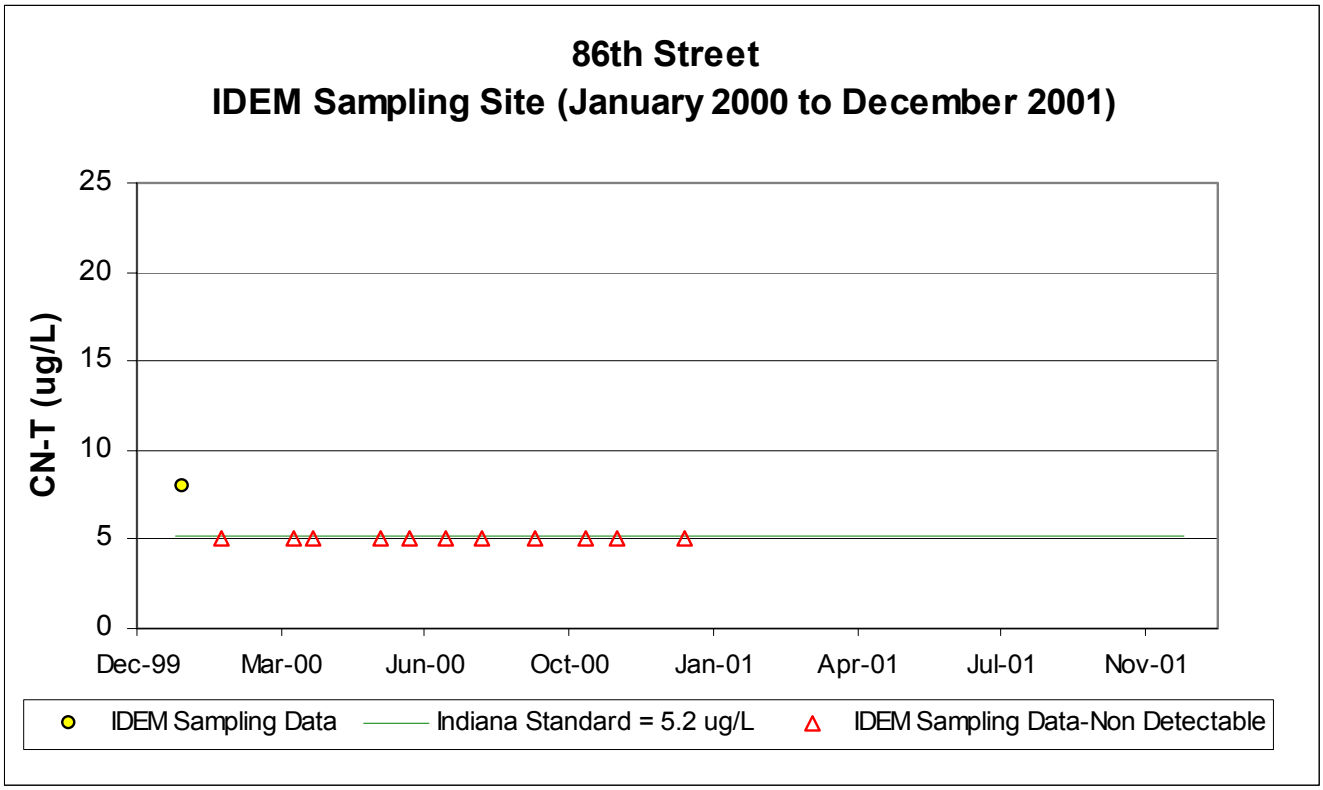


Figure 3.6: White River Cyanide Data



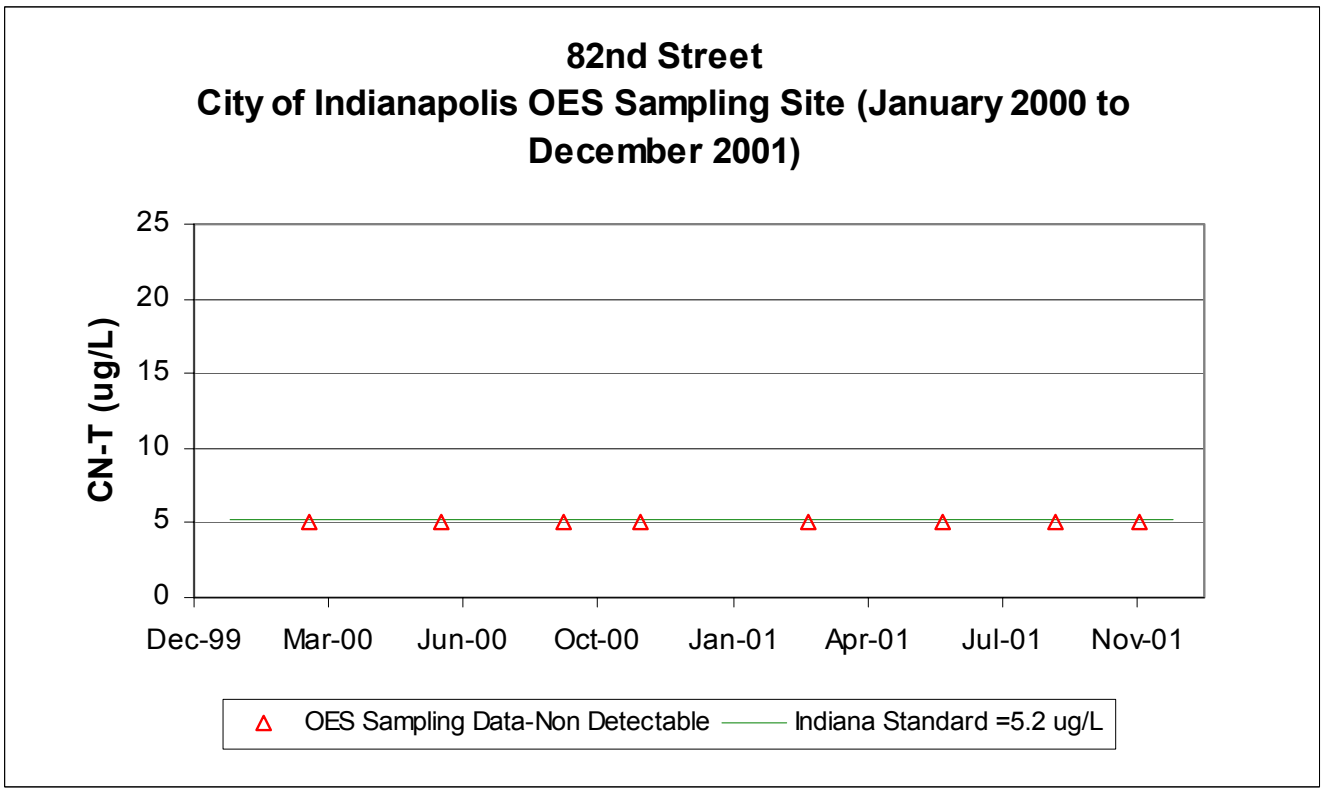
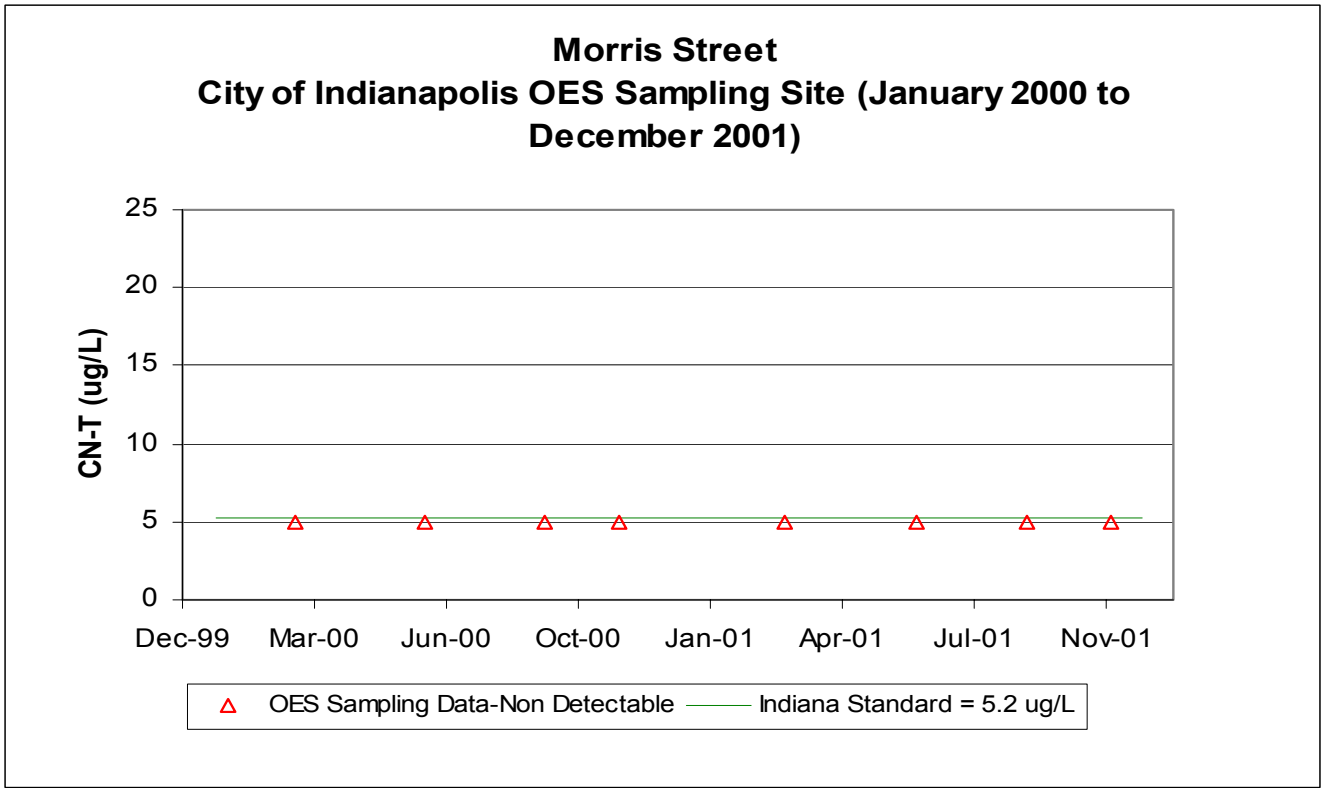


Figure 3.7: White River Cyanide Data



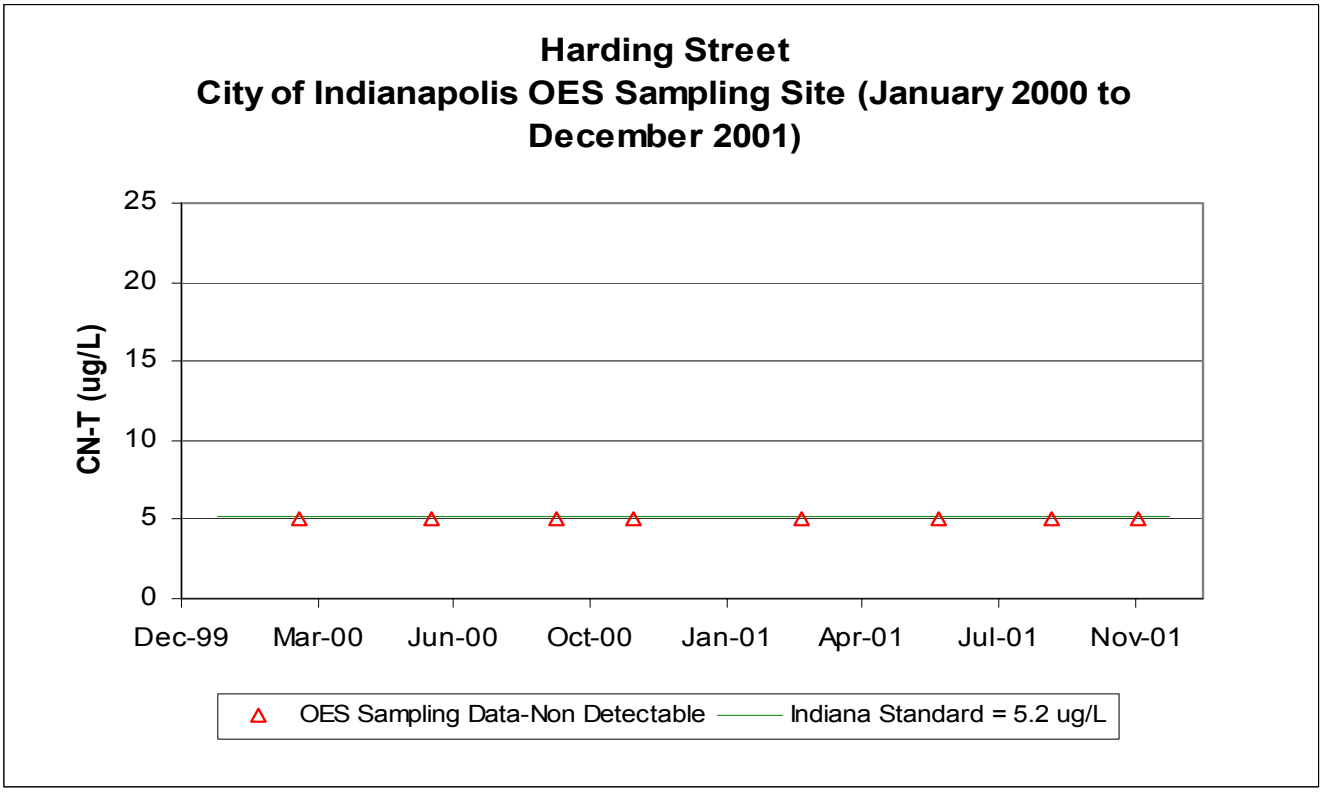
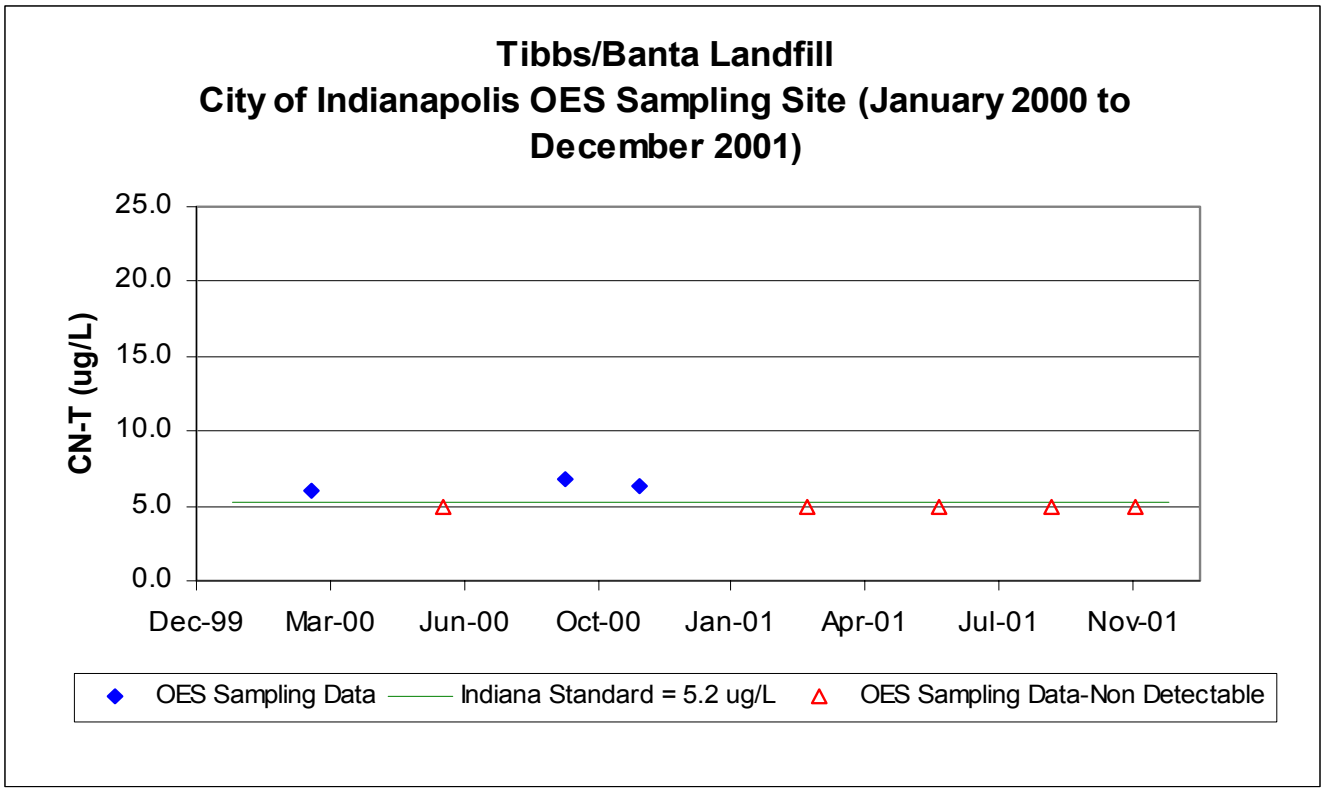


Figure 3.8: White River Cyanide Data



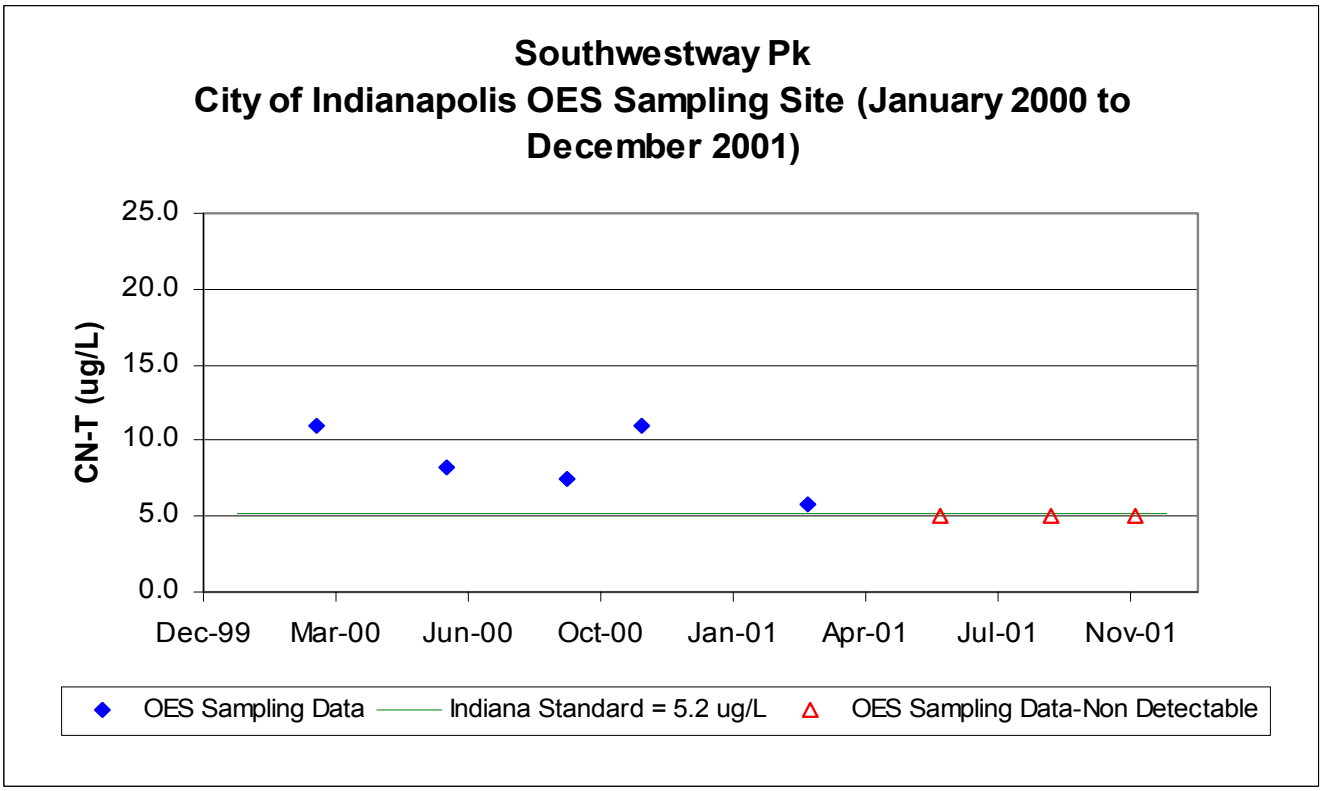
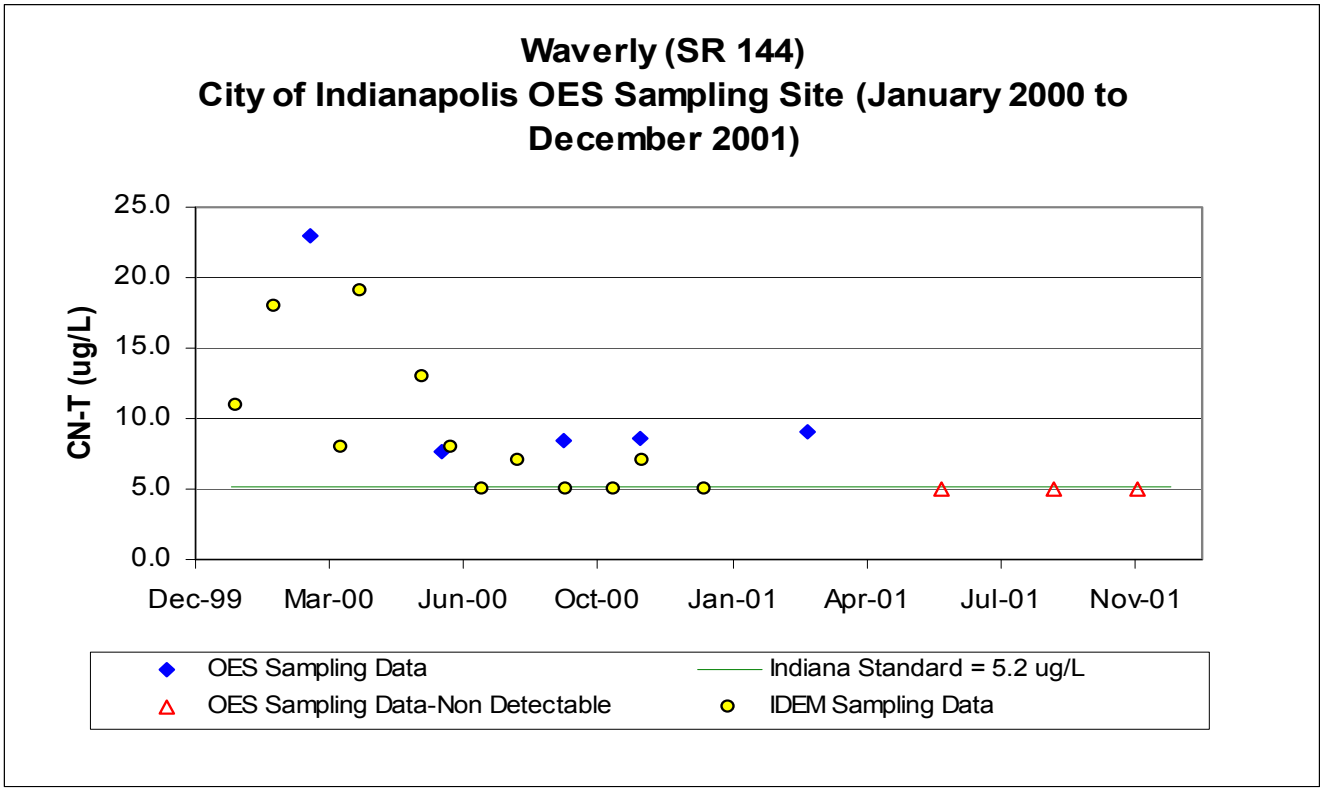


Figure 3.9: White River Cyanide Data



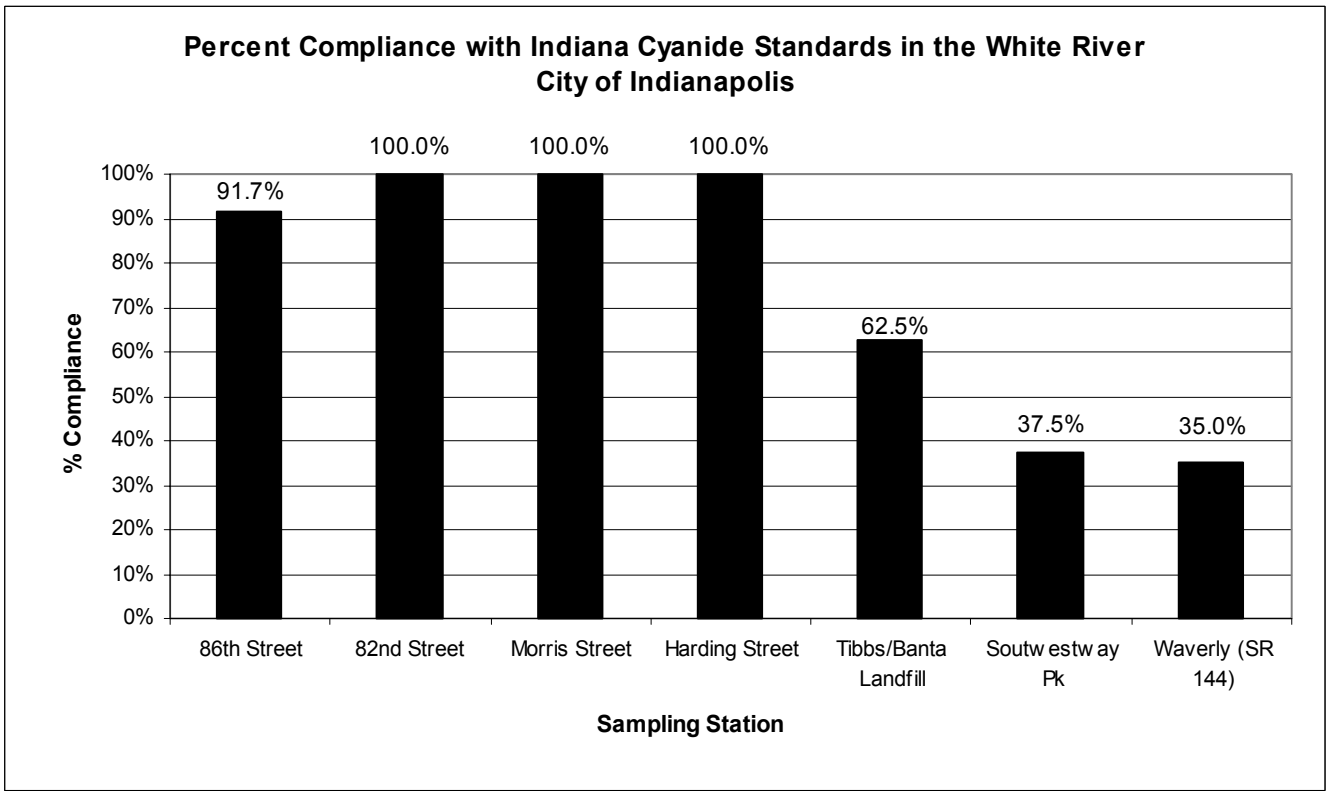


Figure 3.10: White River Dissolved Oxygen Data

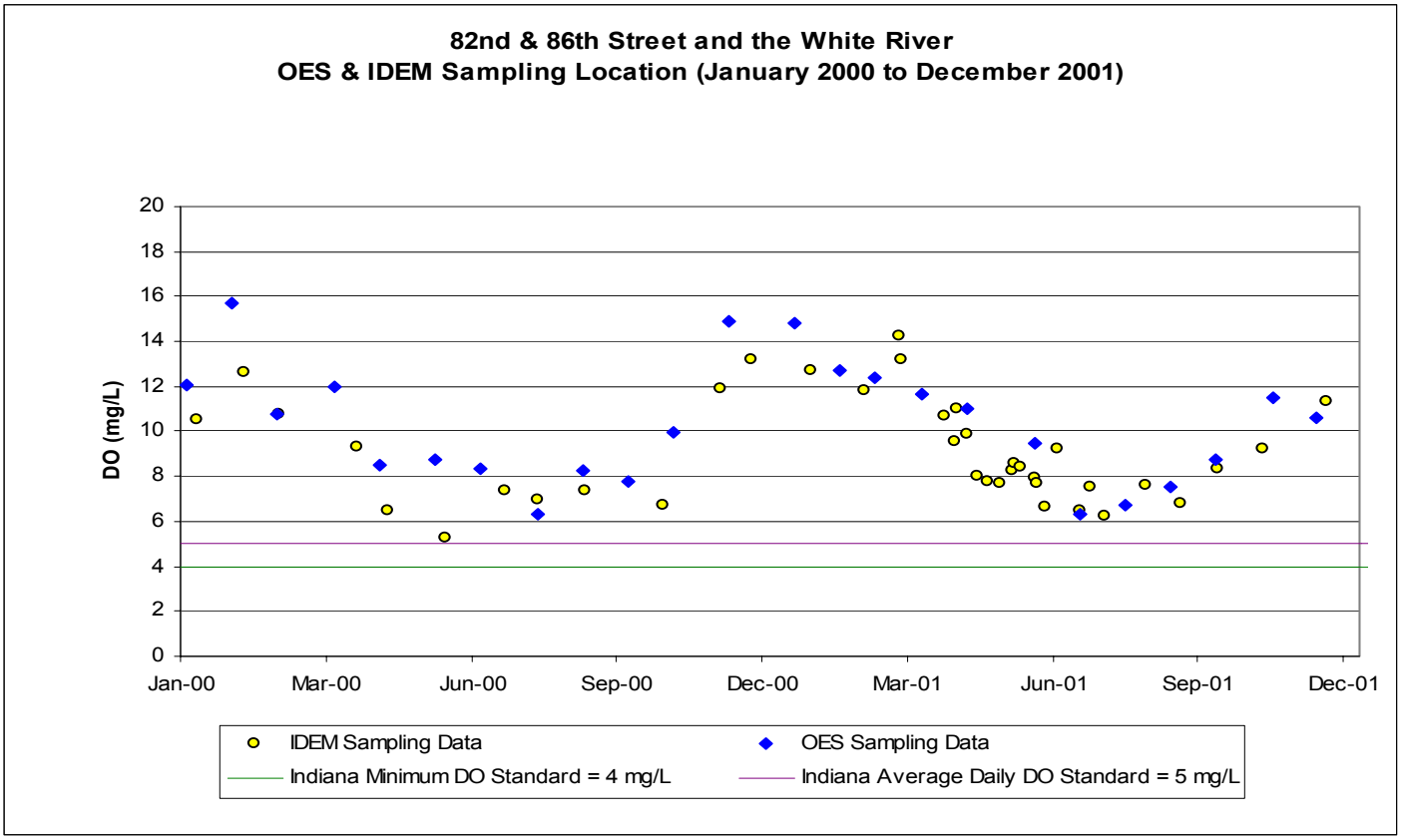
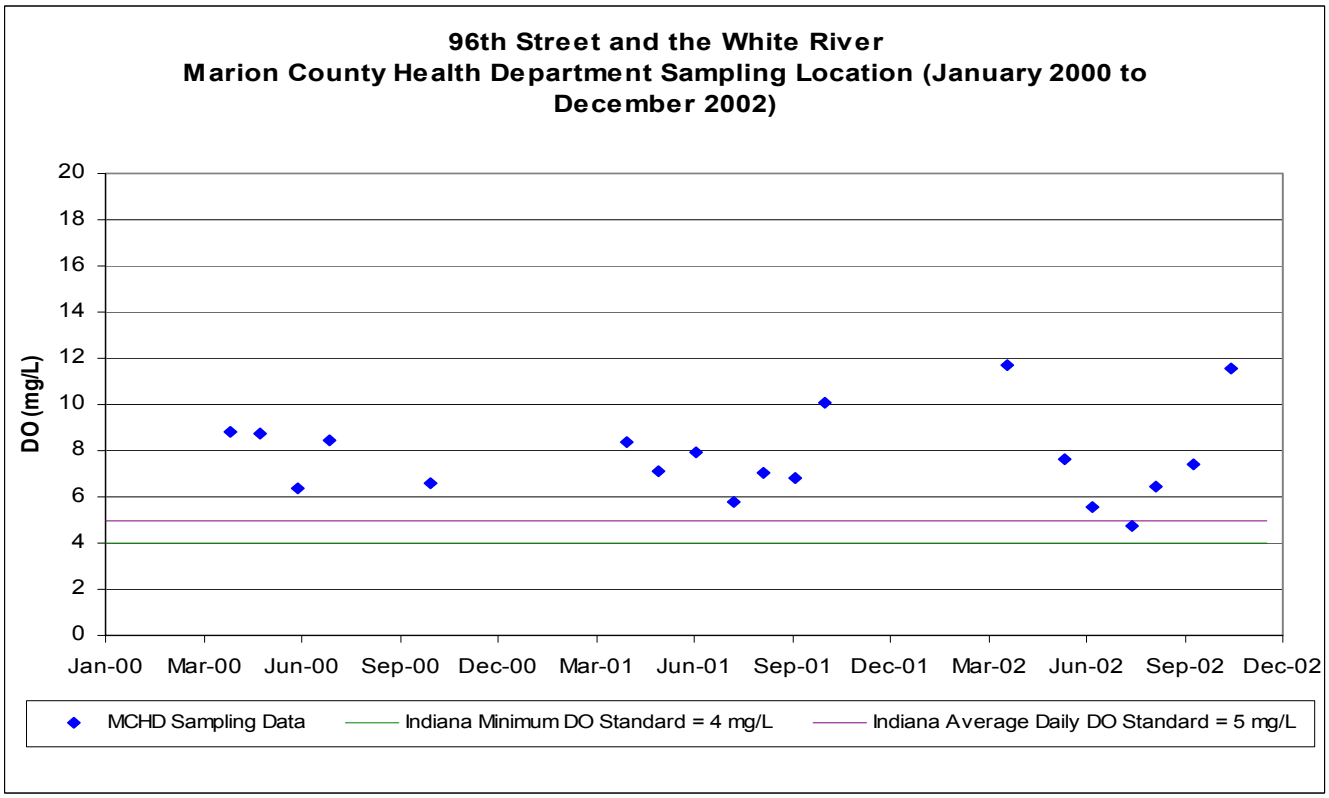


Figure 3.11: White River Dissolved Oxygen Data



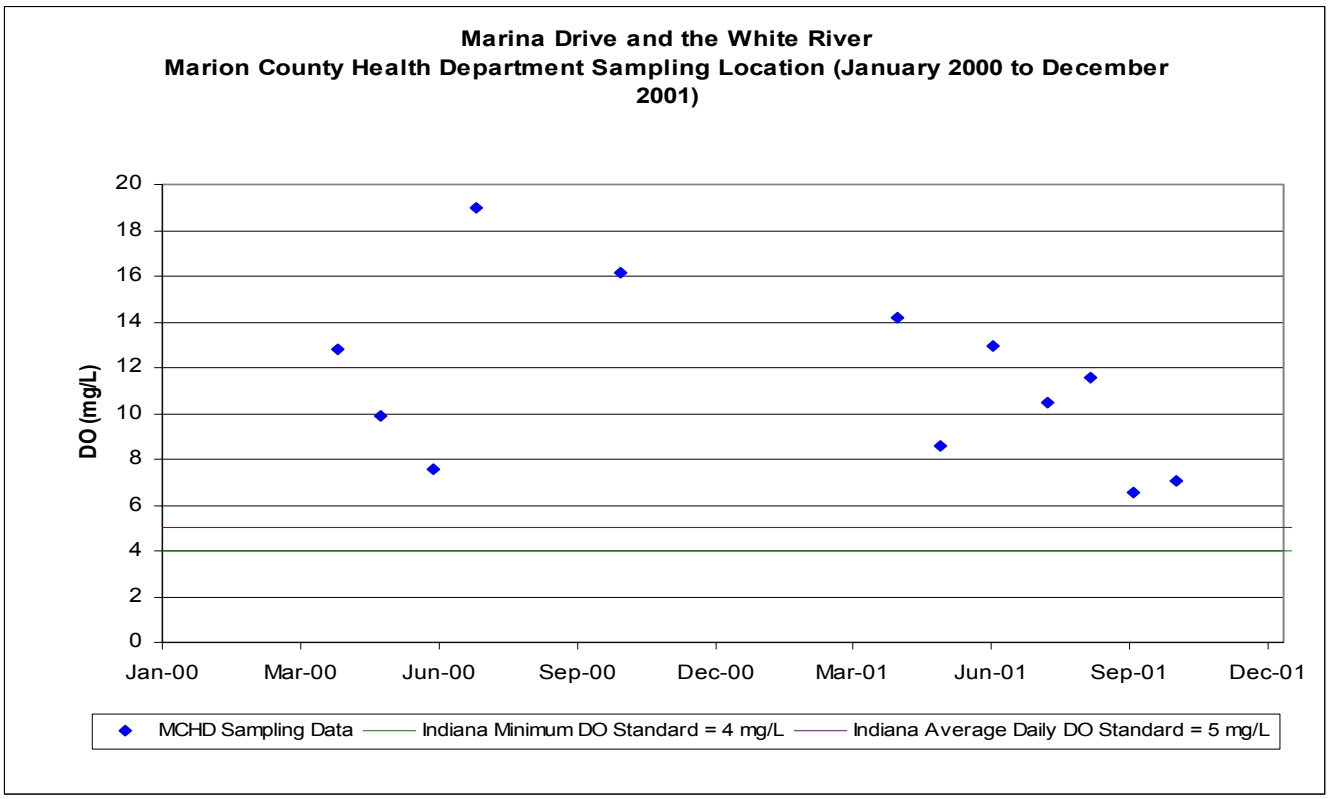
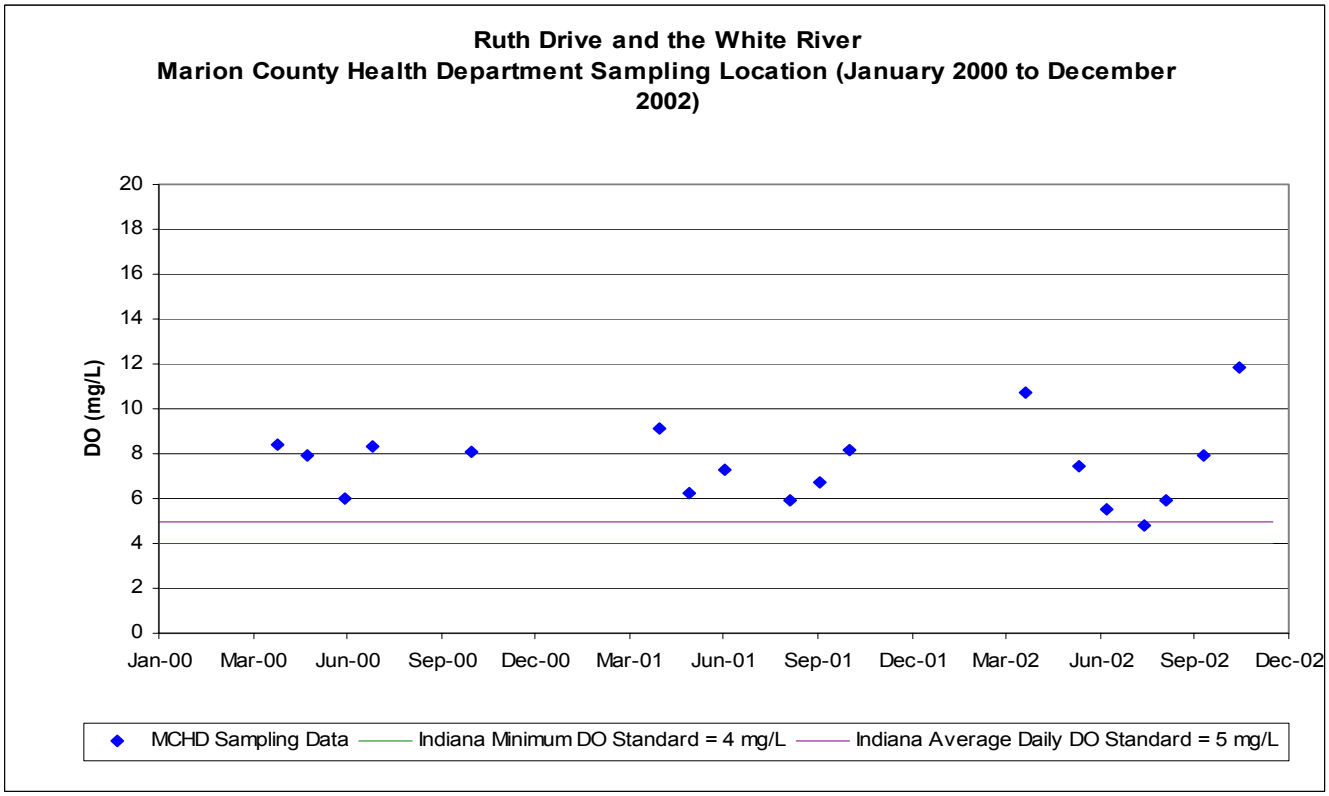


Figure 3.12: White River Dissolved Oxygen Data



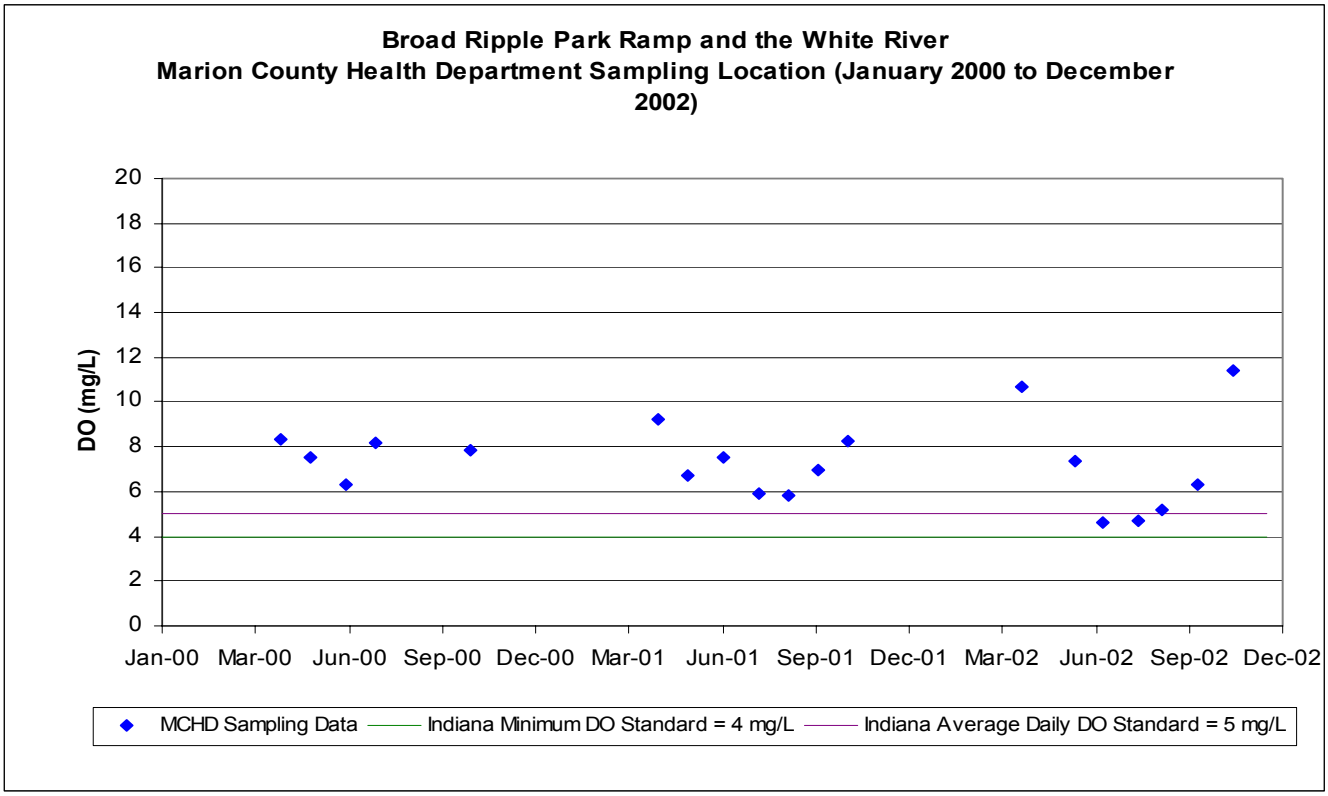
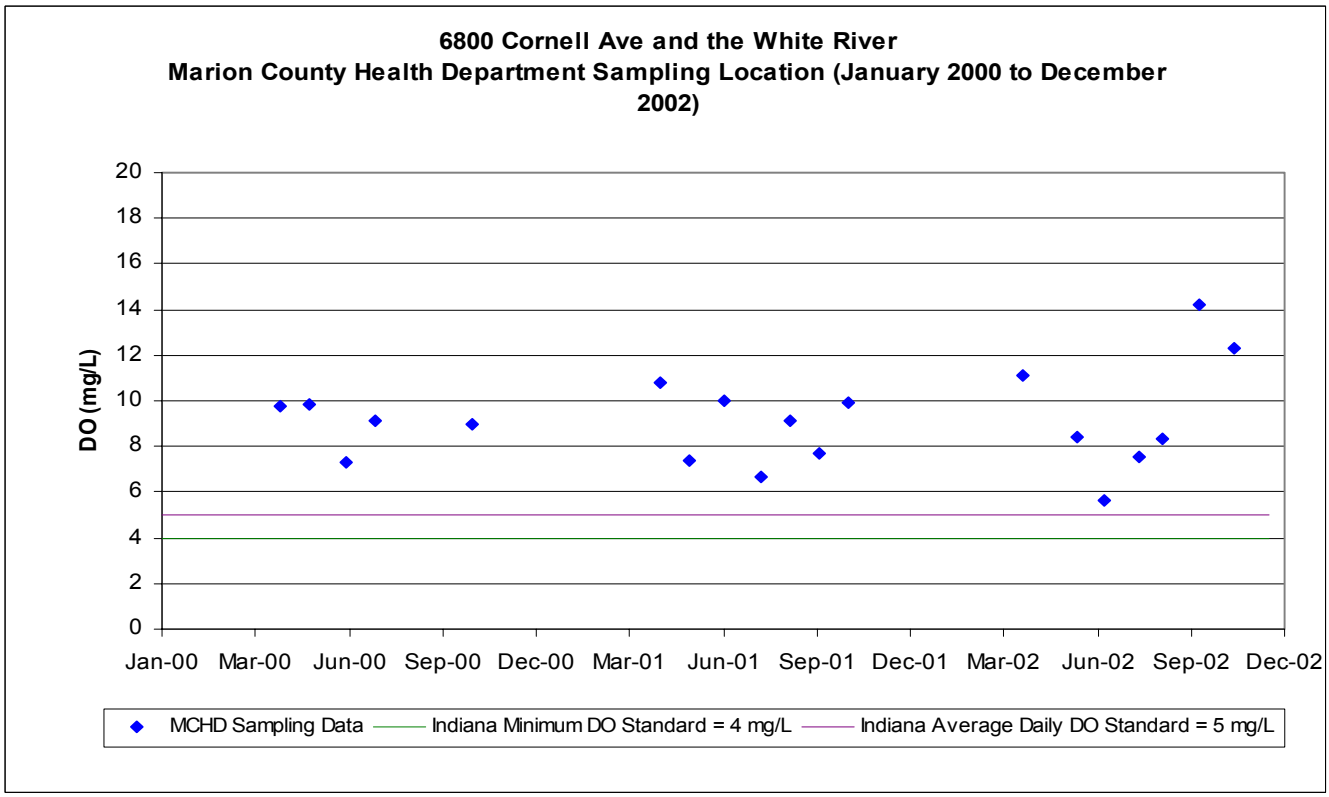


Figure 3.13: White River Dissolved Oxygen Data



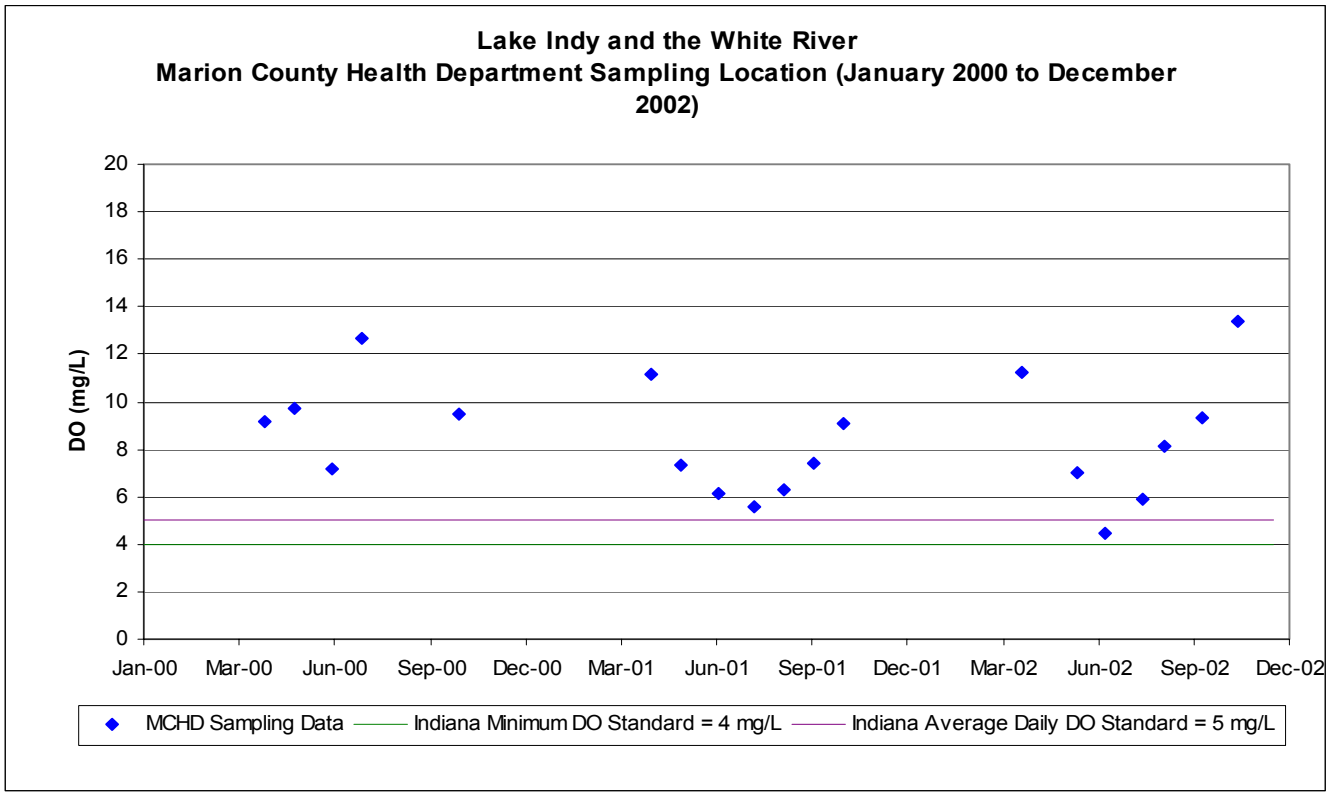
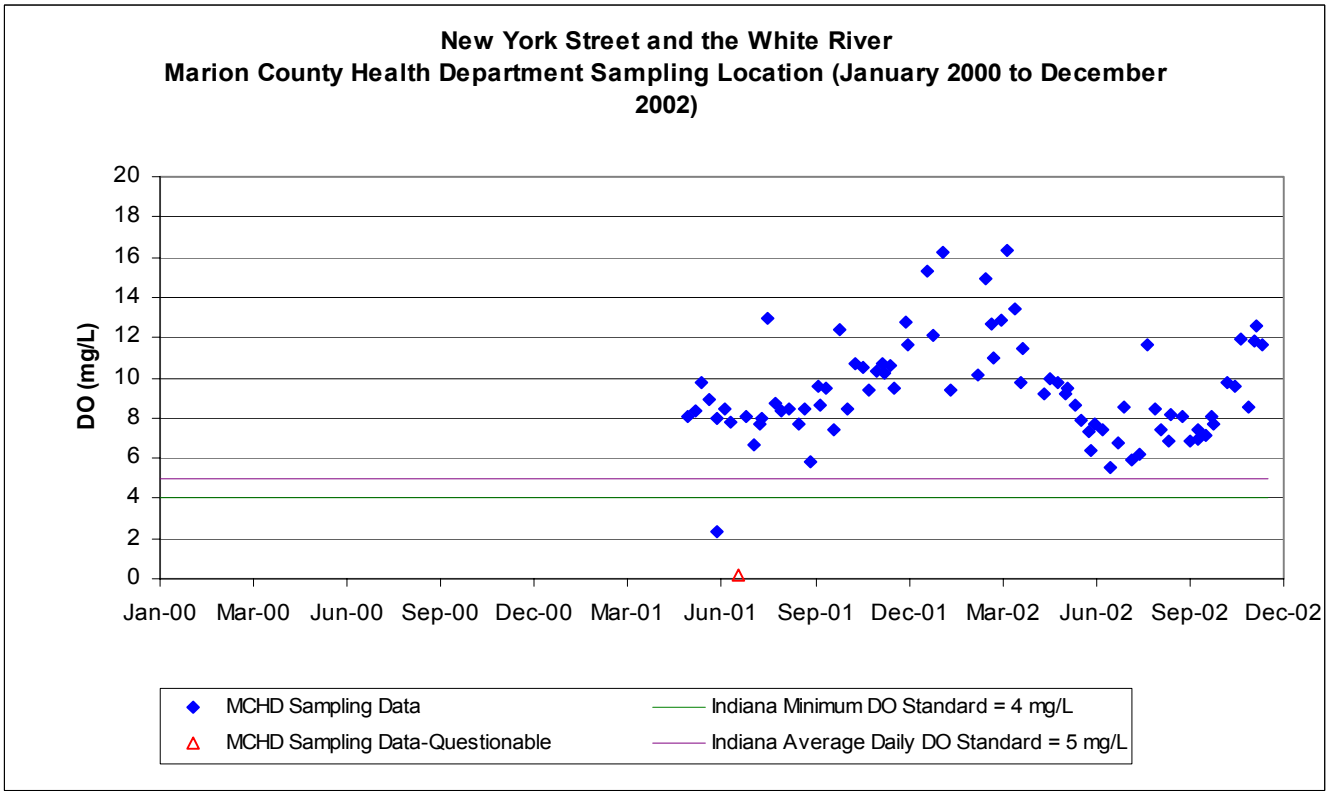


Figure 3.14: White River Dissolved Oxygen Data



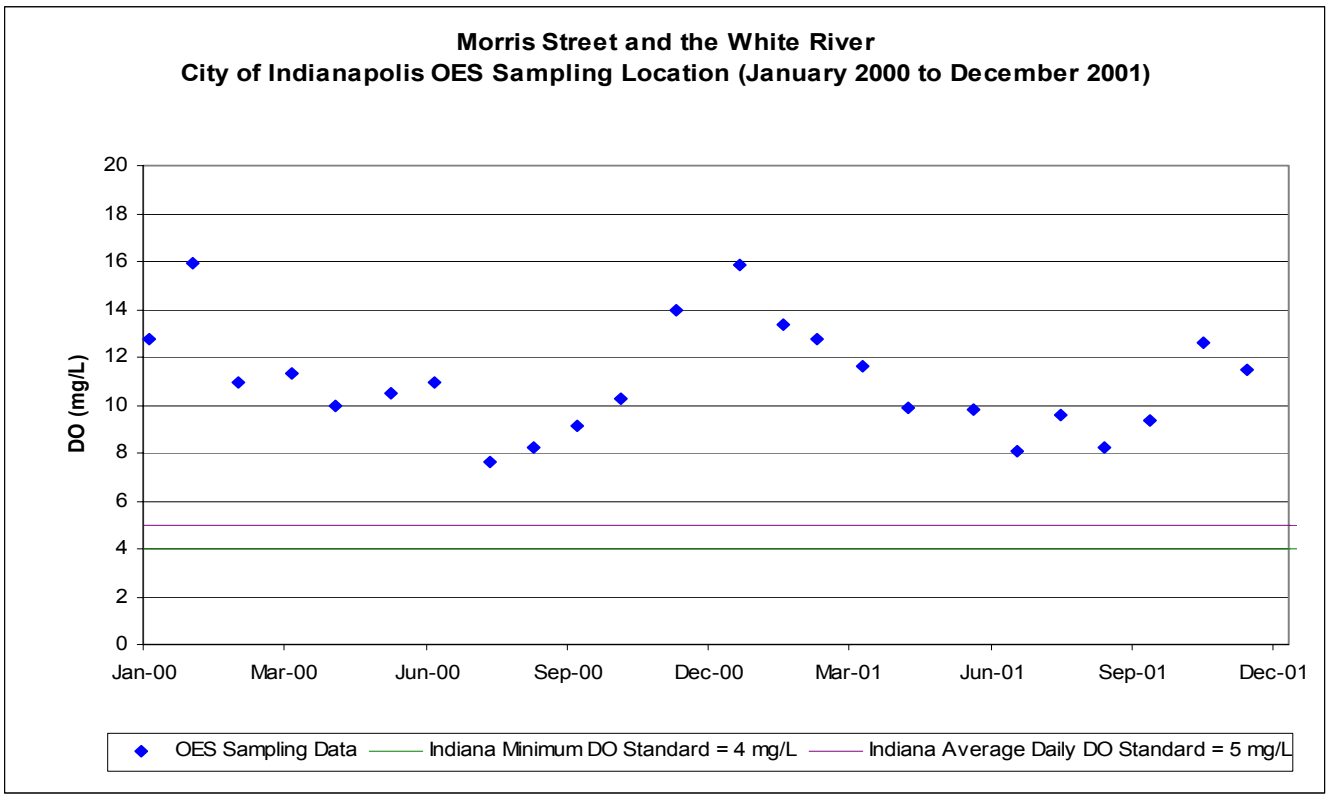
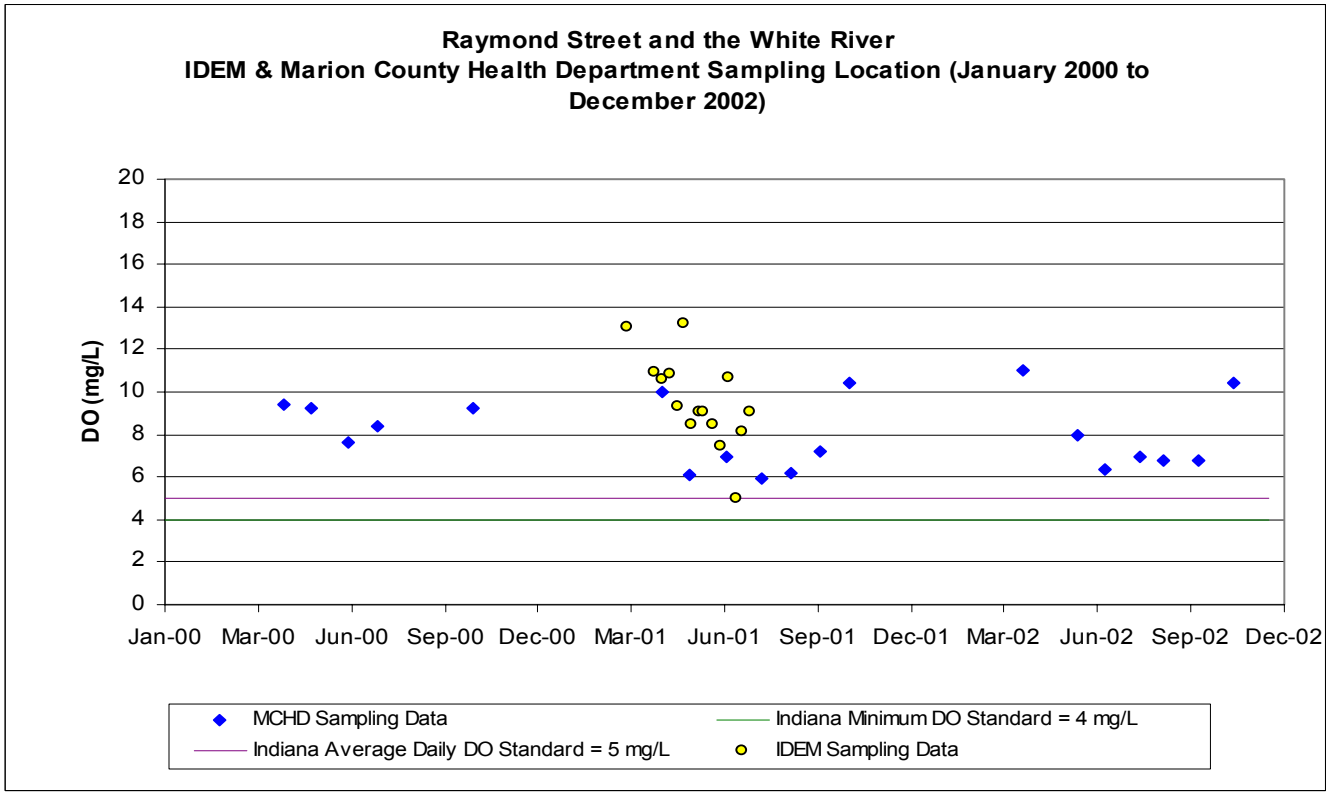


Figure 3.15: White River Dissolved Oxygen Data



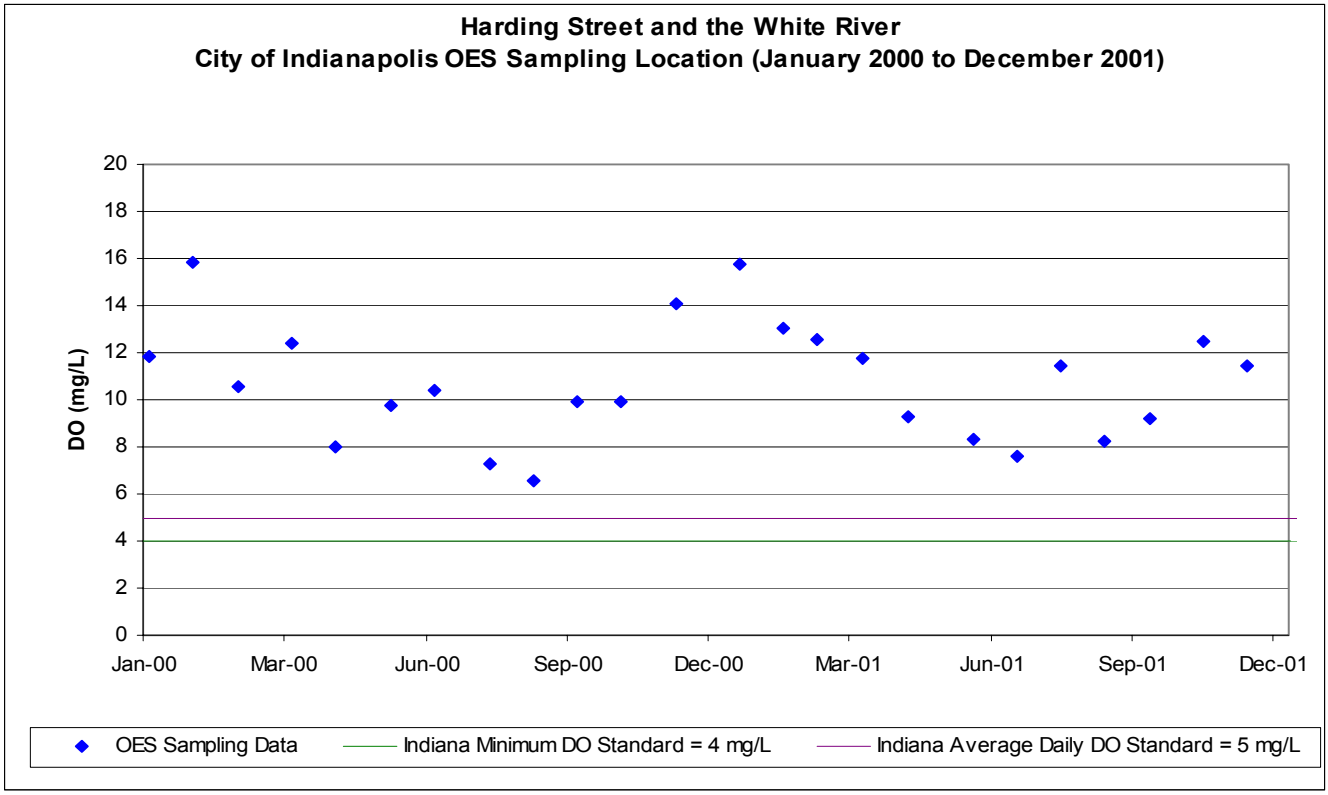
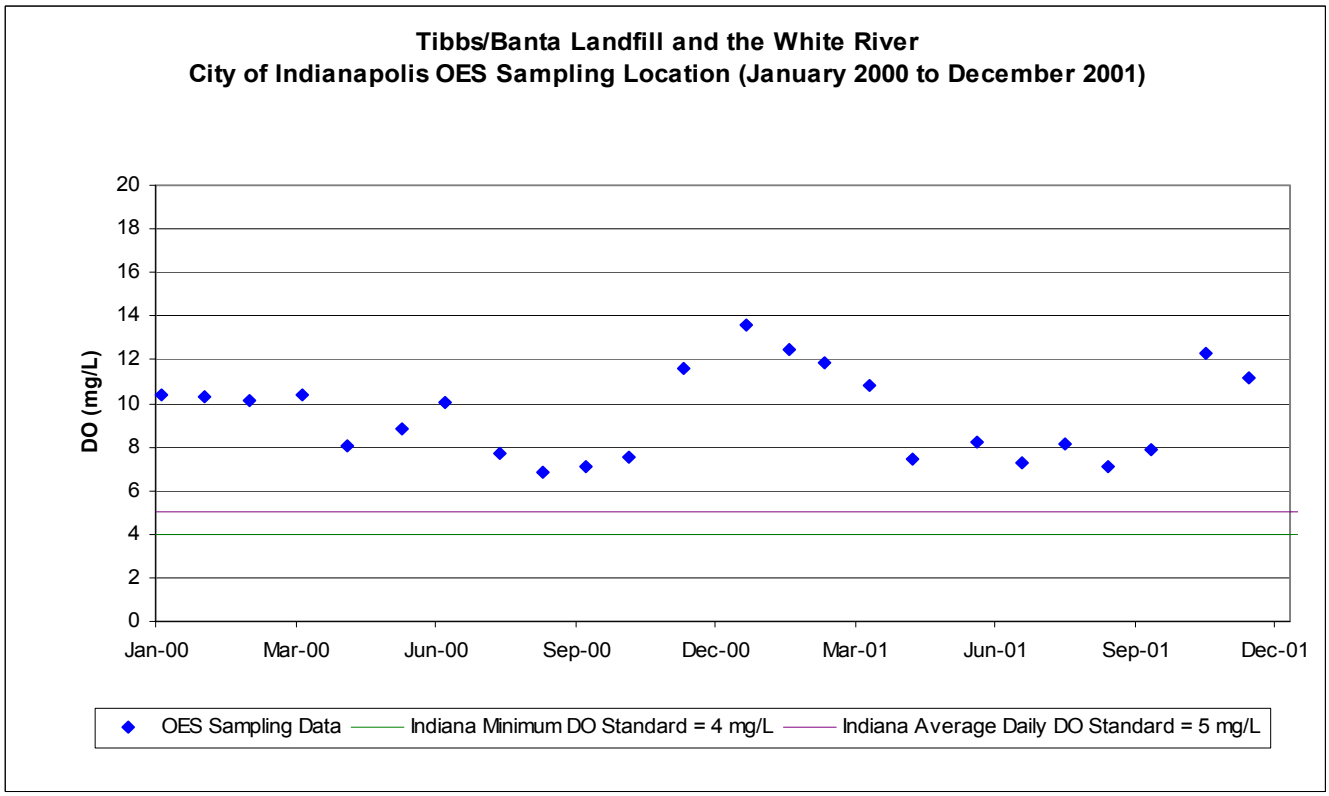


Figure 3.16: White River Dissolved Oxygen Data



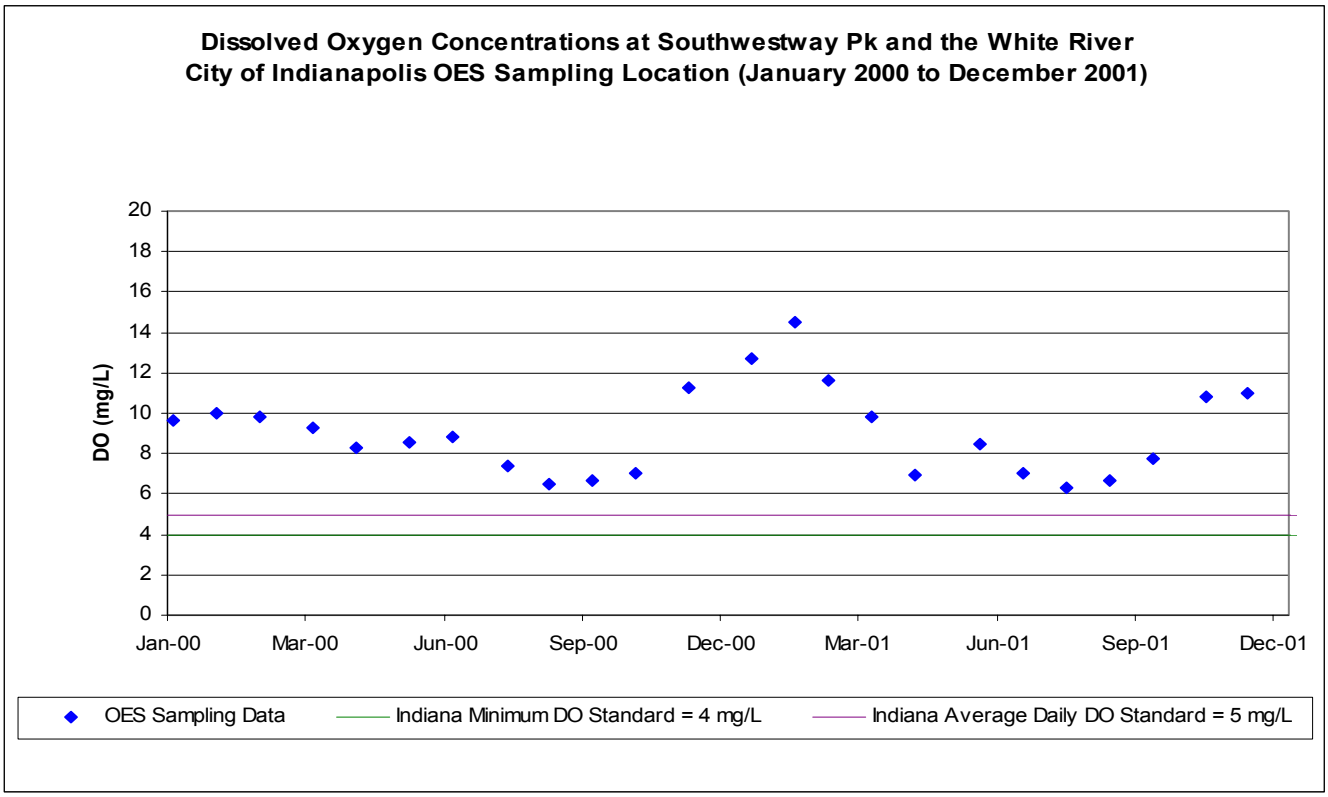


Figure 3.17: White River Dissolved Oxygen Data

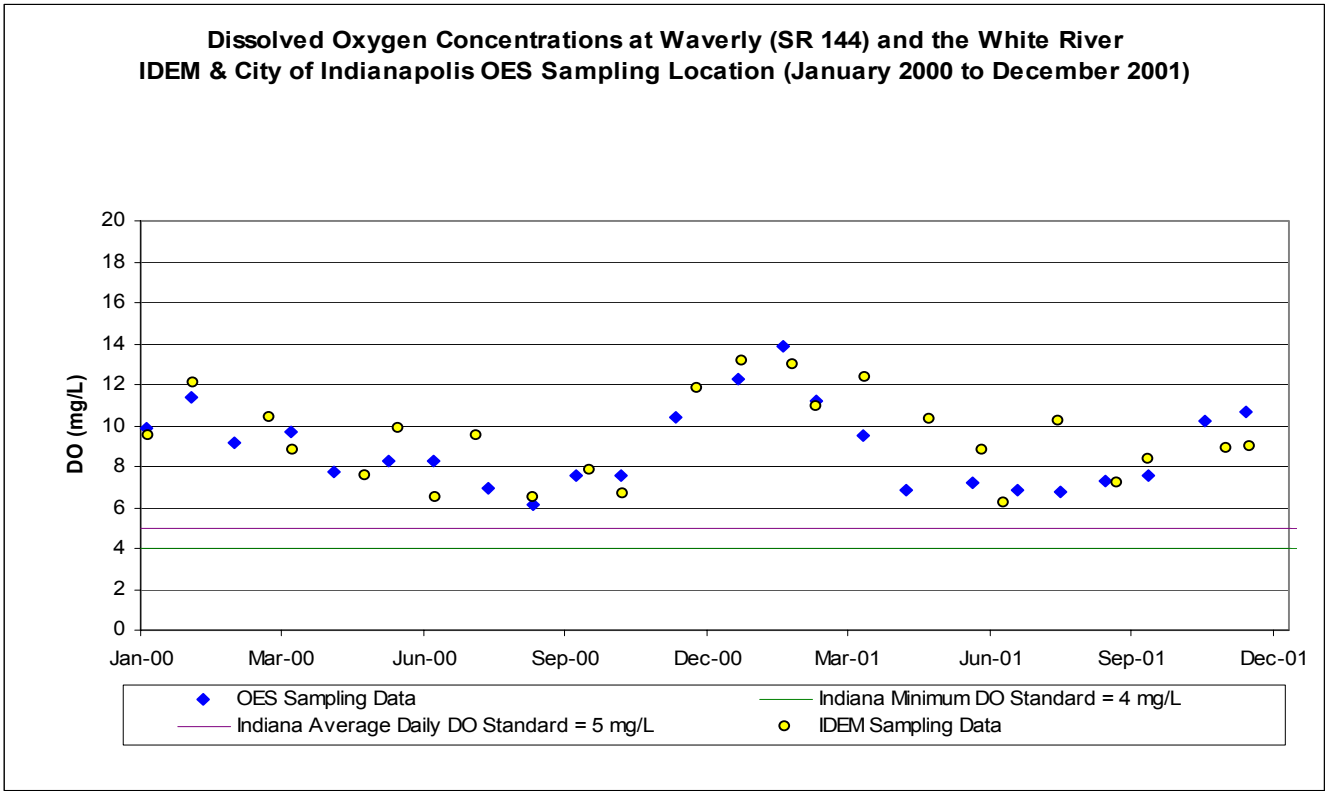
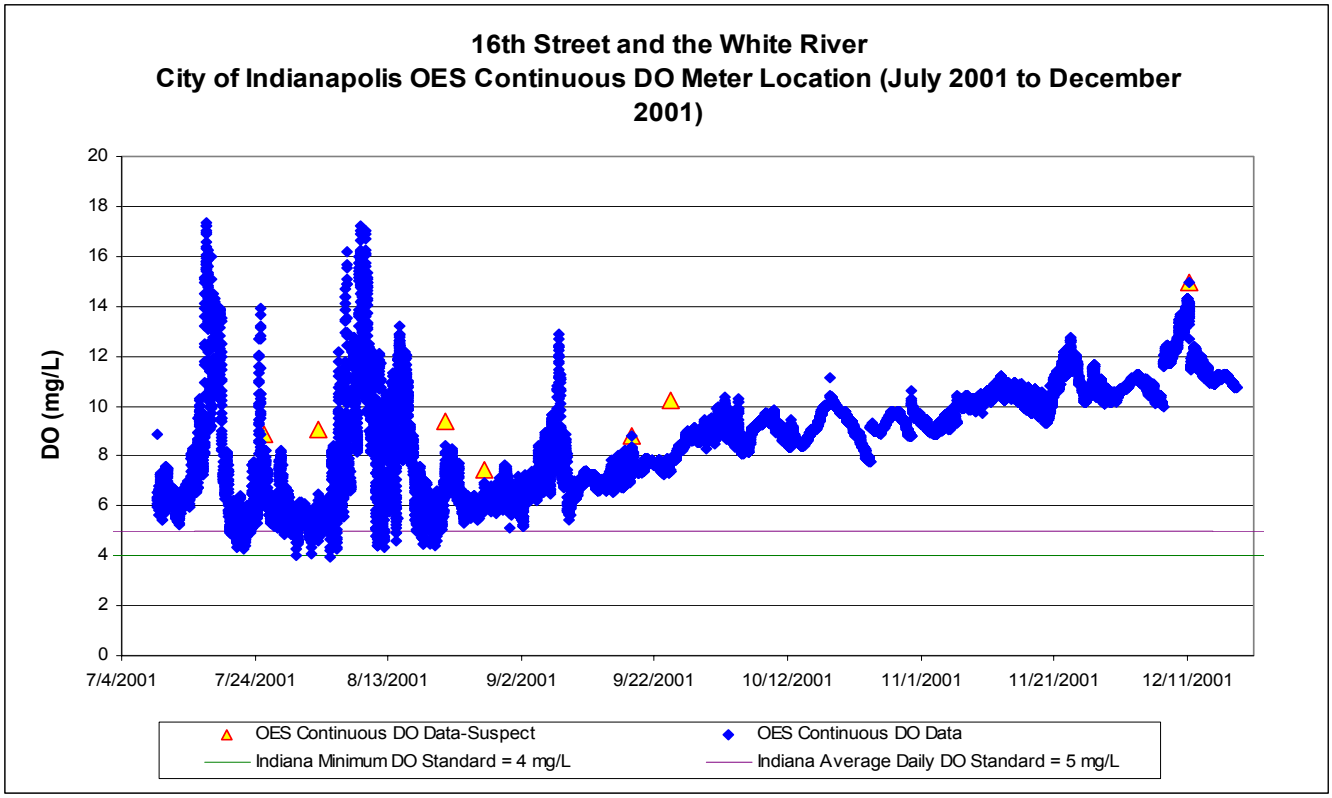


Figure 3.18: White River Continuous Dissolved Oxygen Data



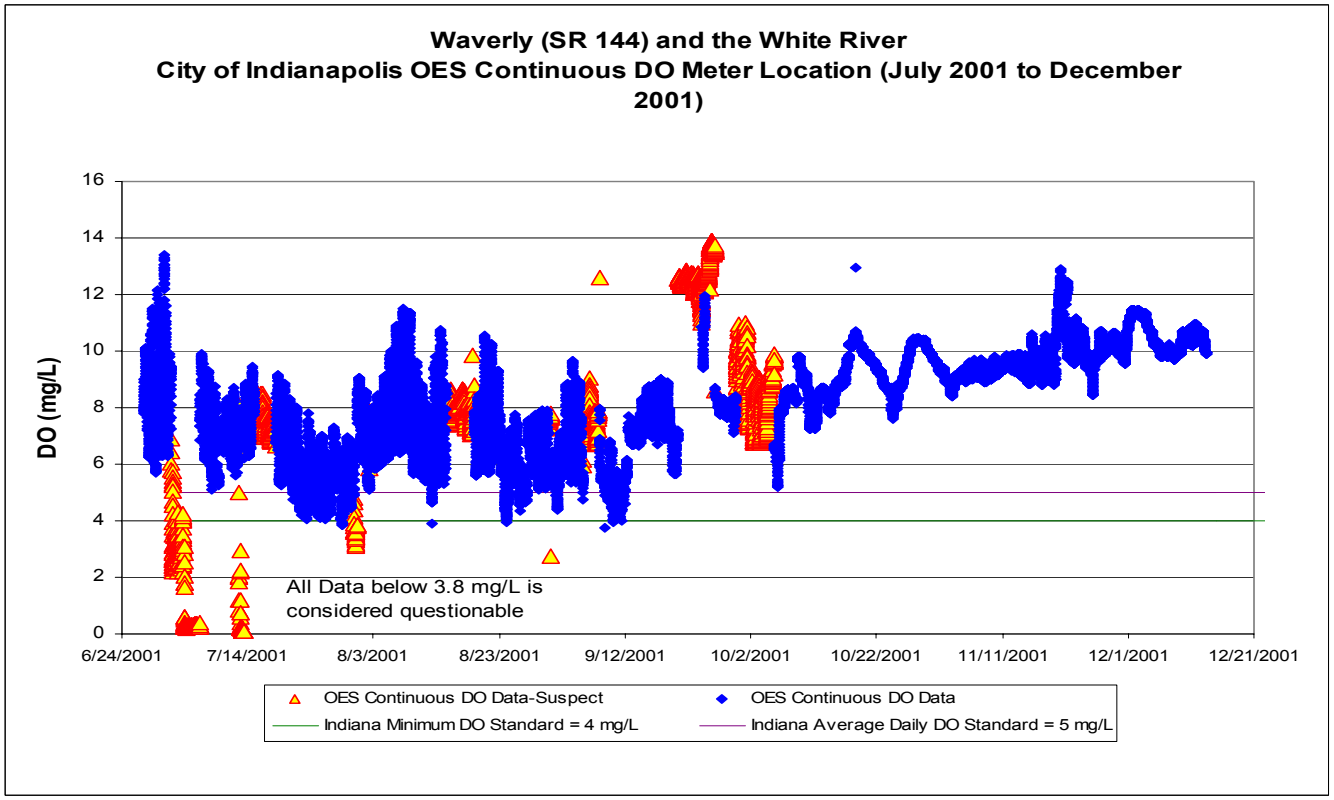


Figure 3.19: White River Continuous Dissolved Oxygen Data

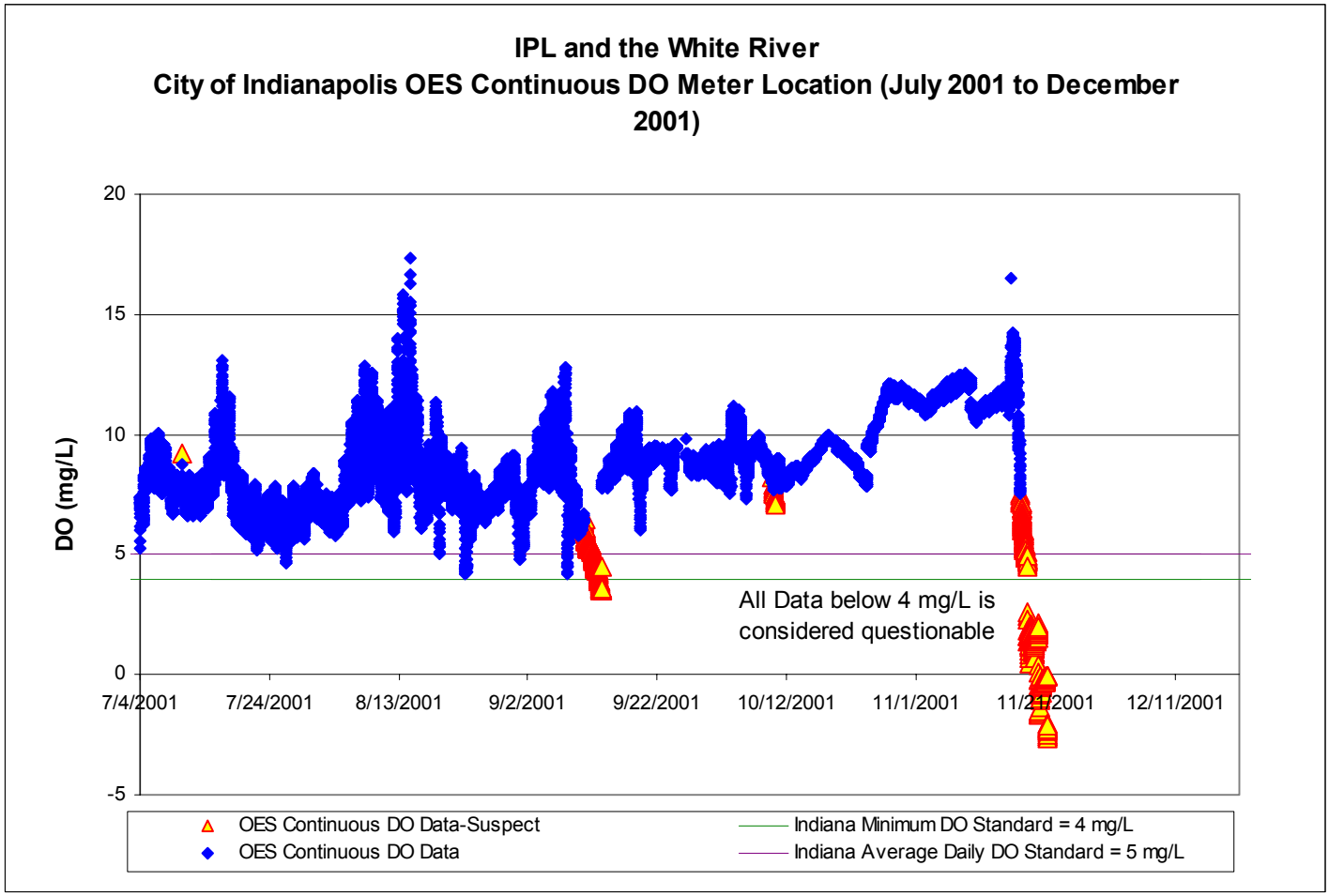
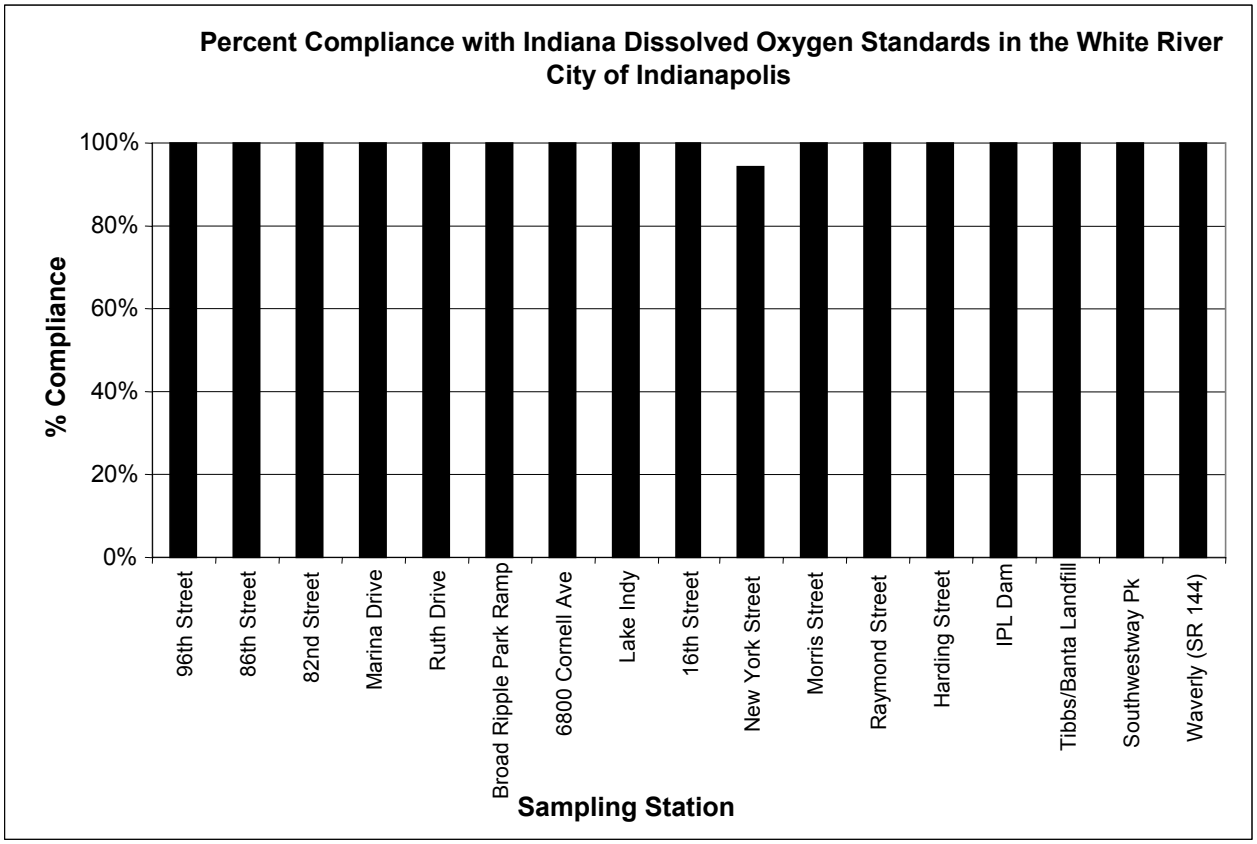


Figure 3.20: White River Dissolved Oxygen Data



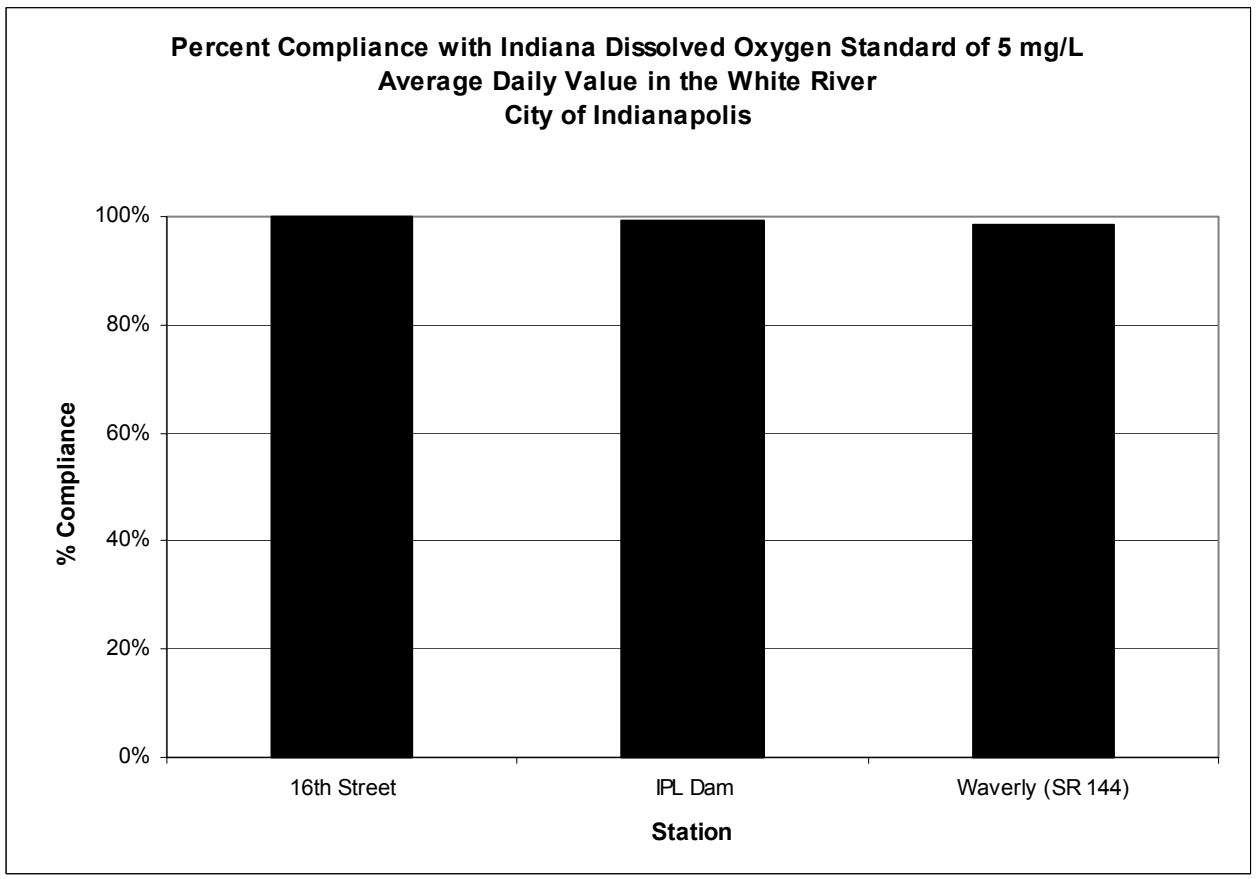
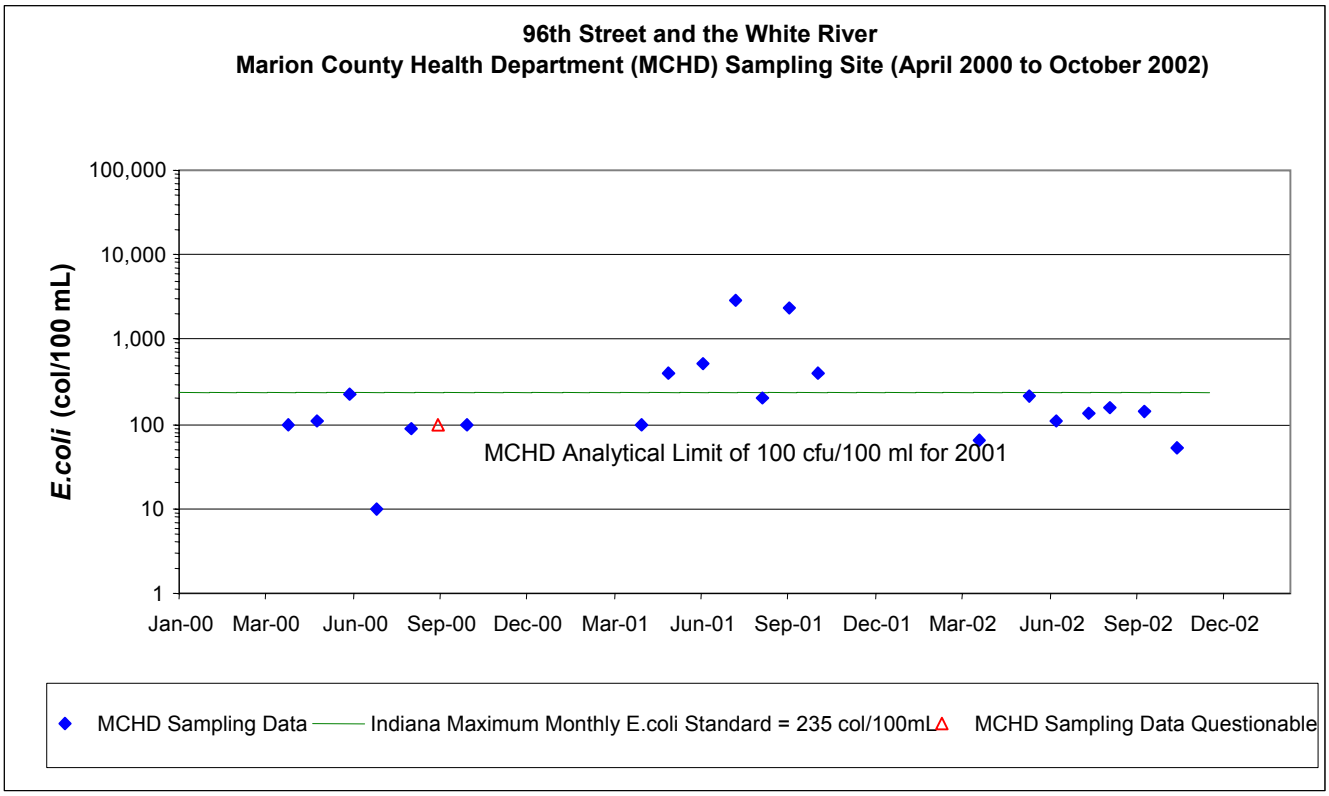


Figure 3.21: White River *E. coli* Data



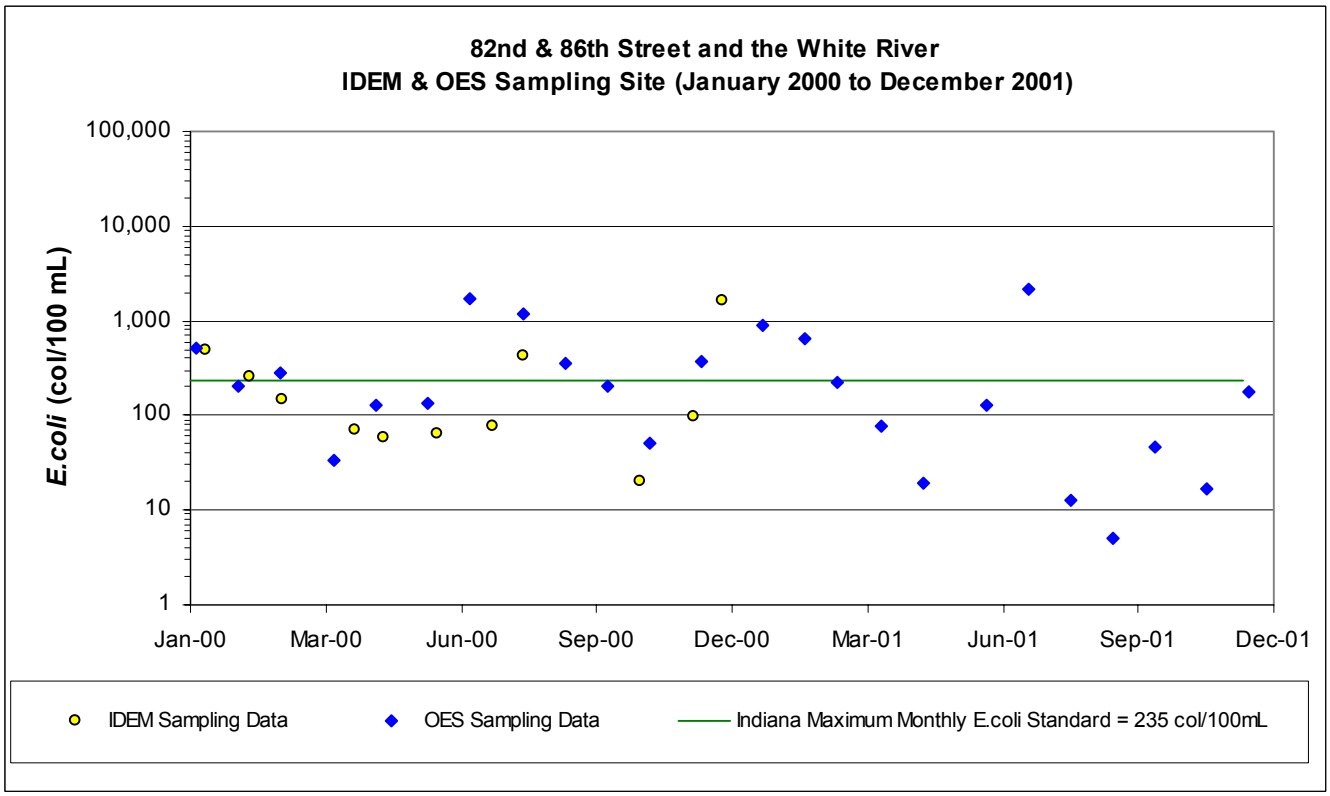


Figure 3.22: White River *E. coli* Data

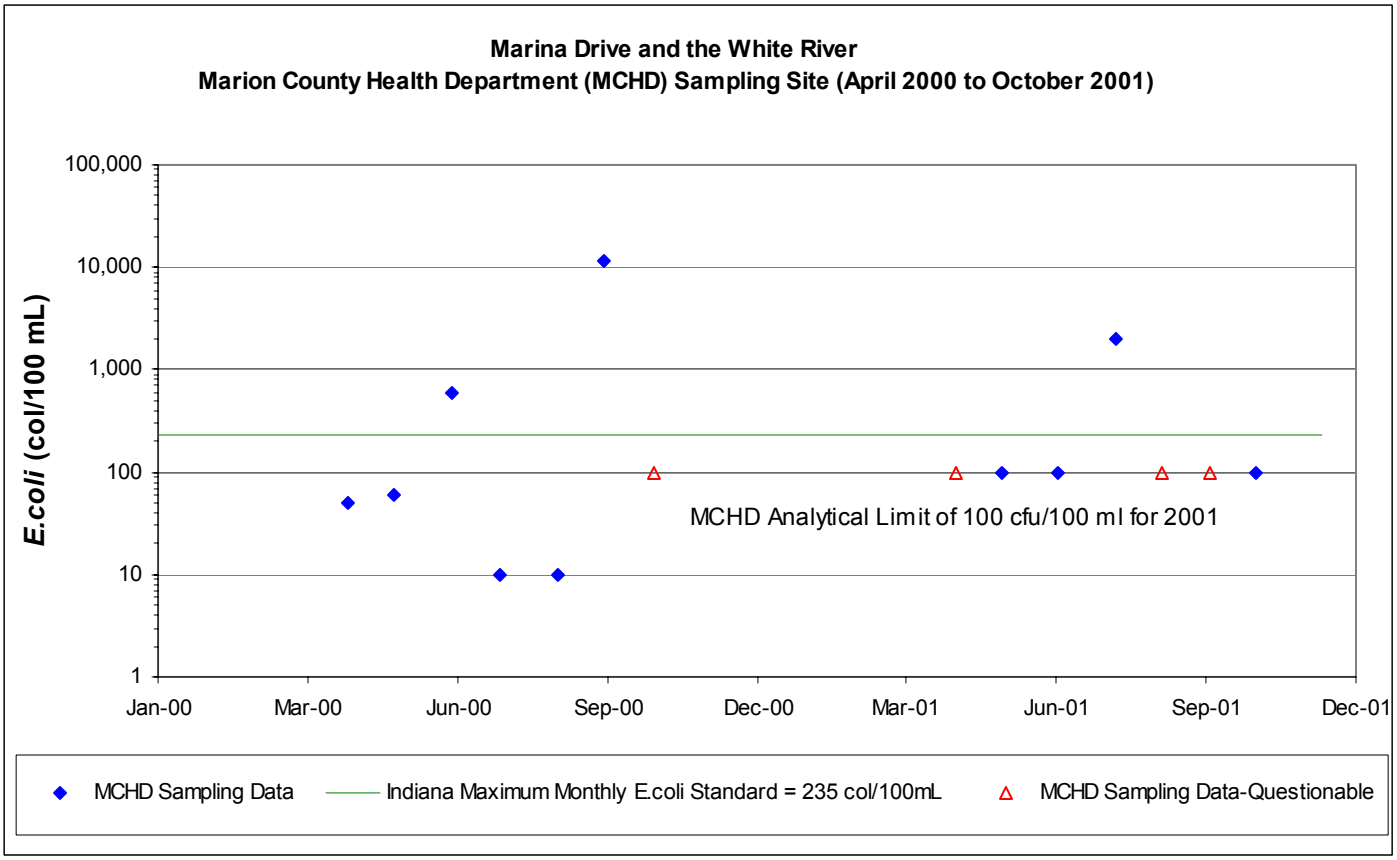
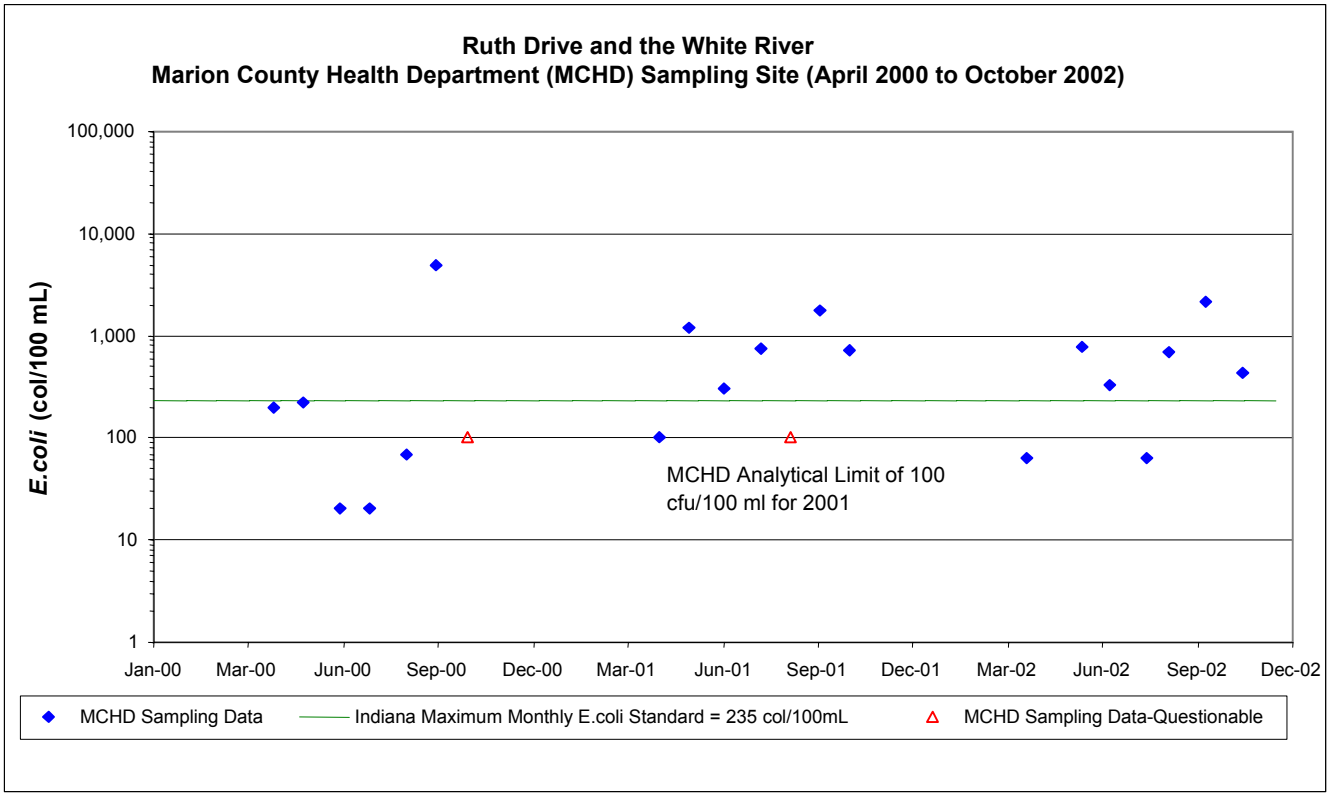


Figure 3.23: White River *E. coli* Data



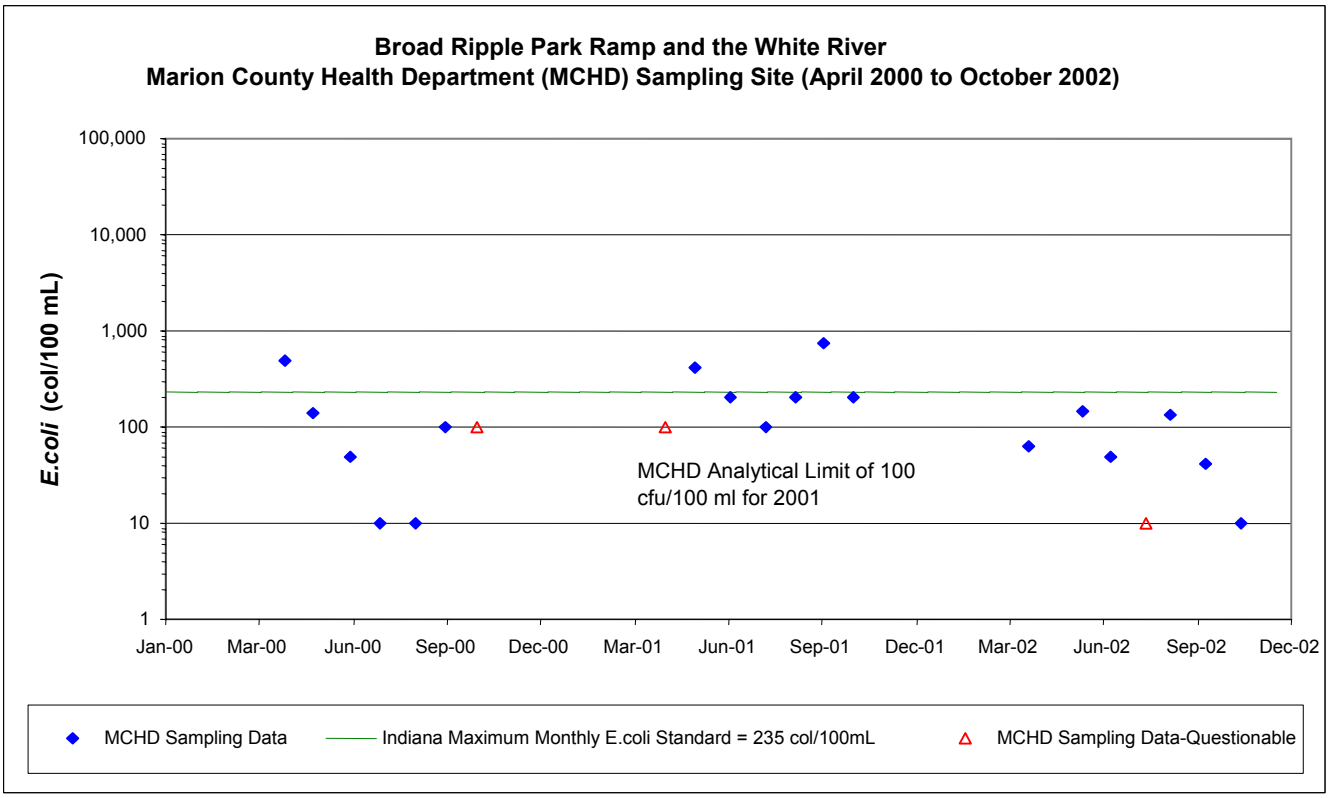
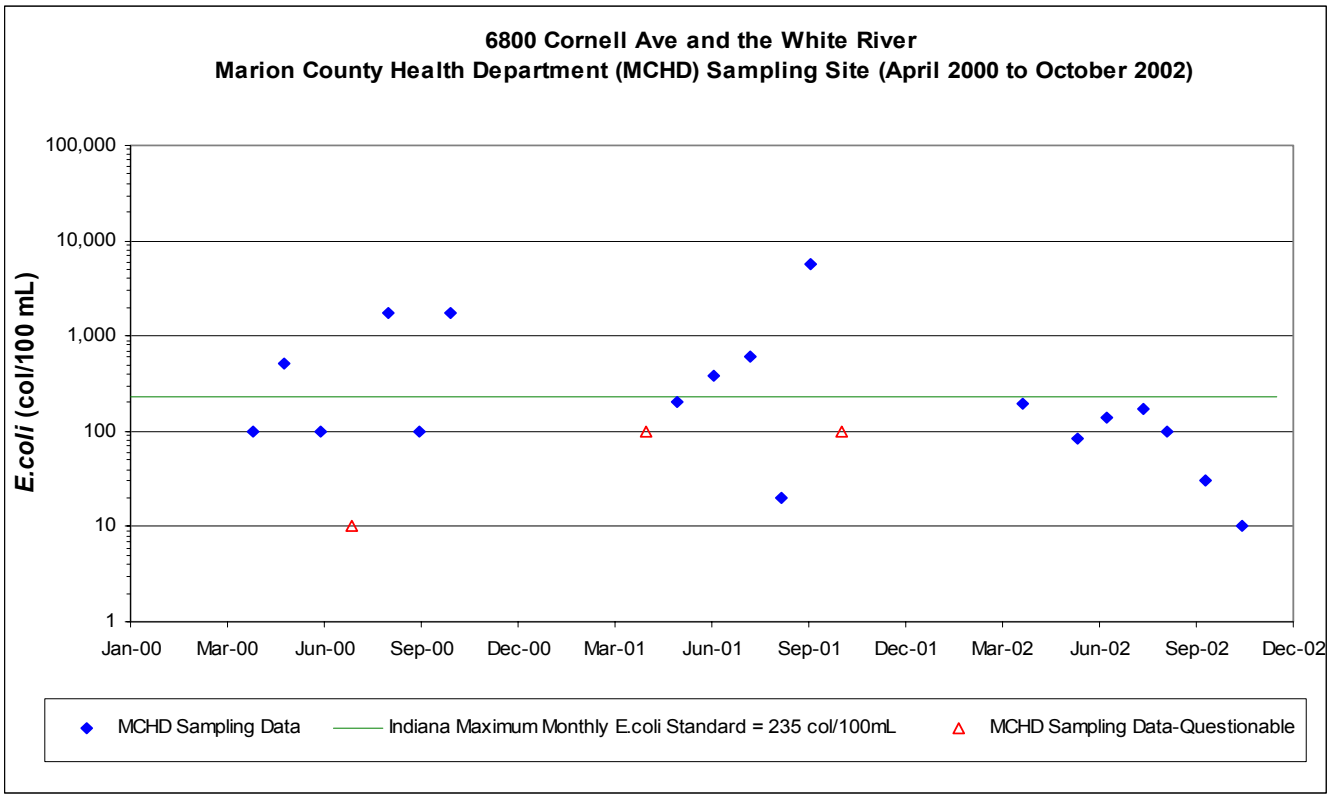


Figure 3.24: White River *E. coli* Data



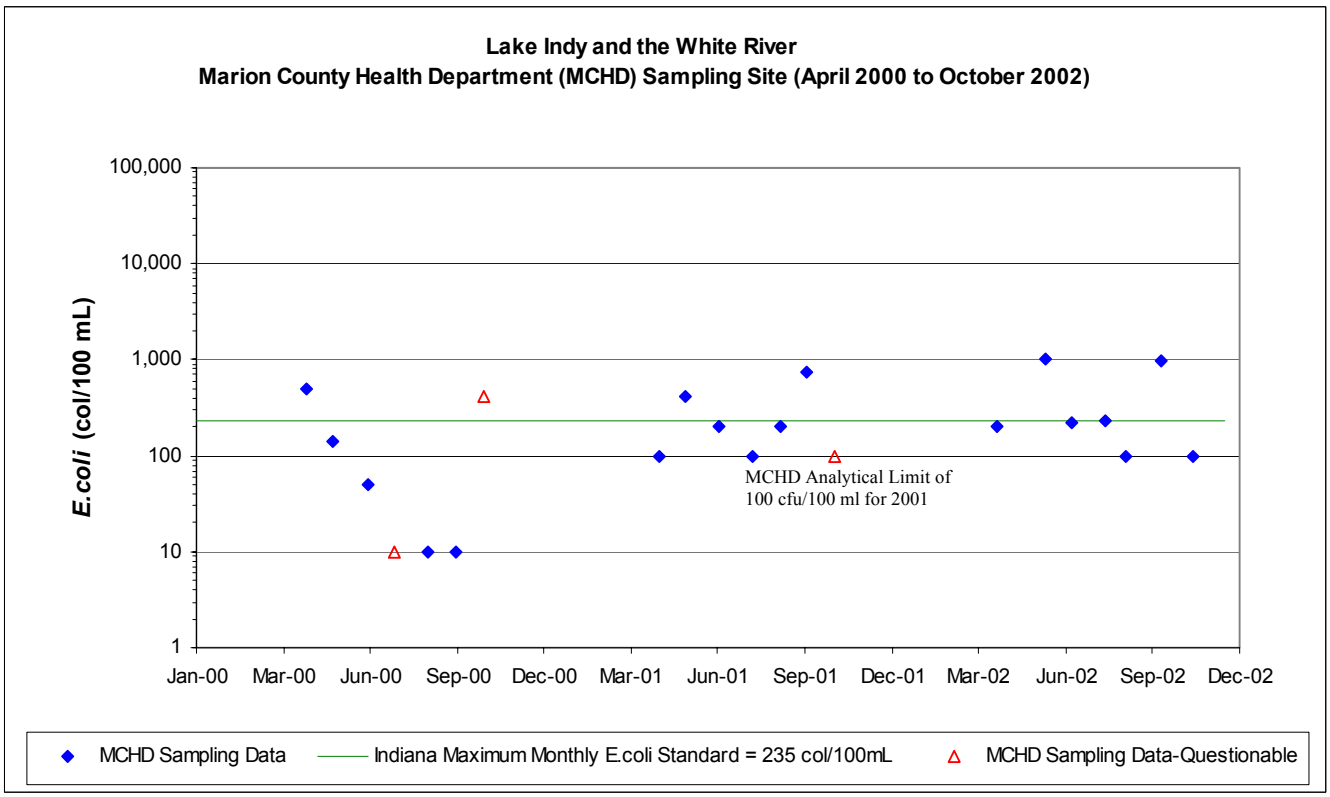
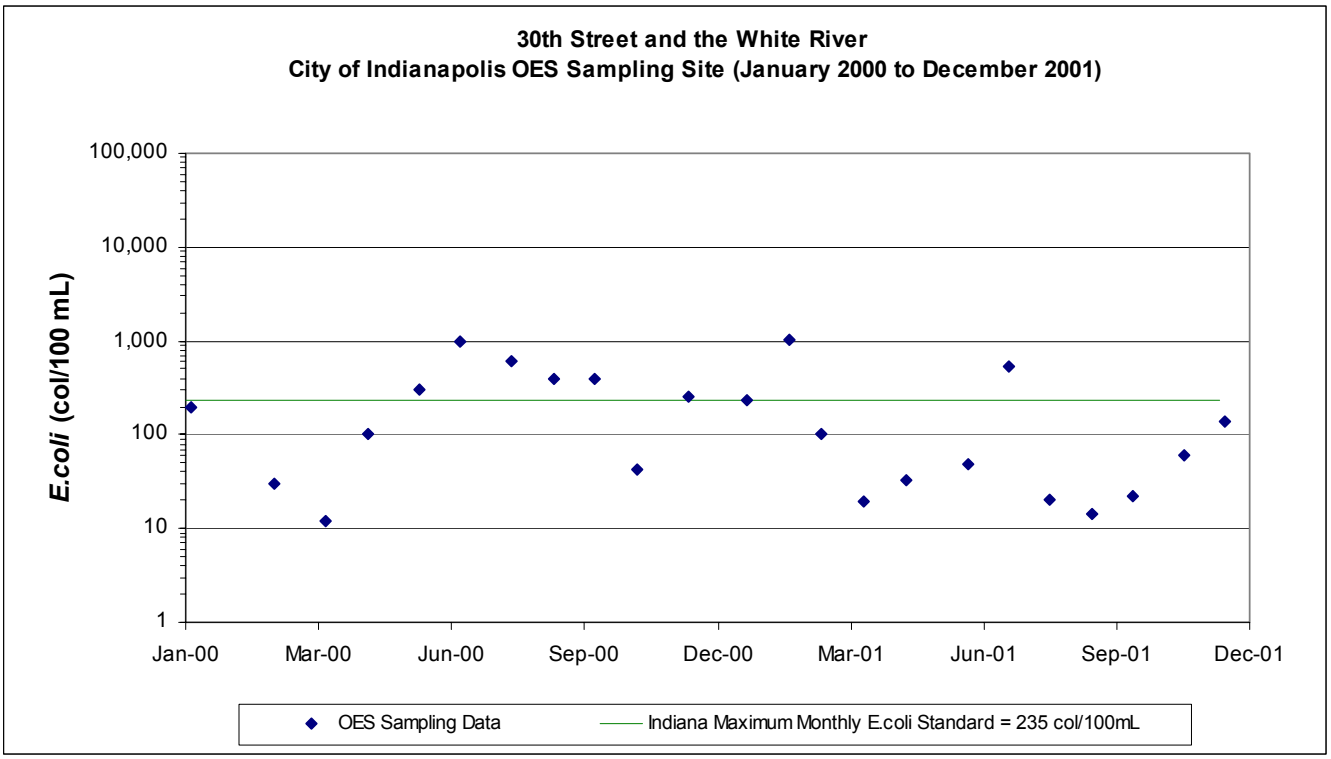


Figure 3.25: White River *E. coli* Data



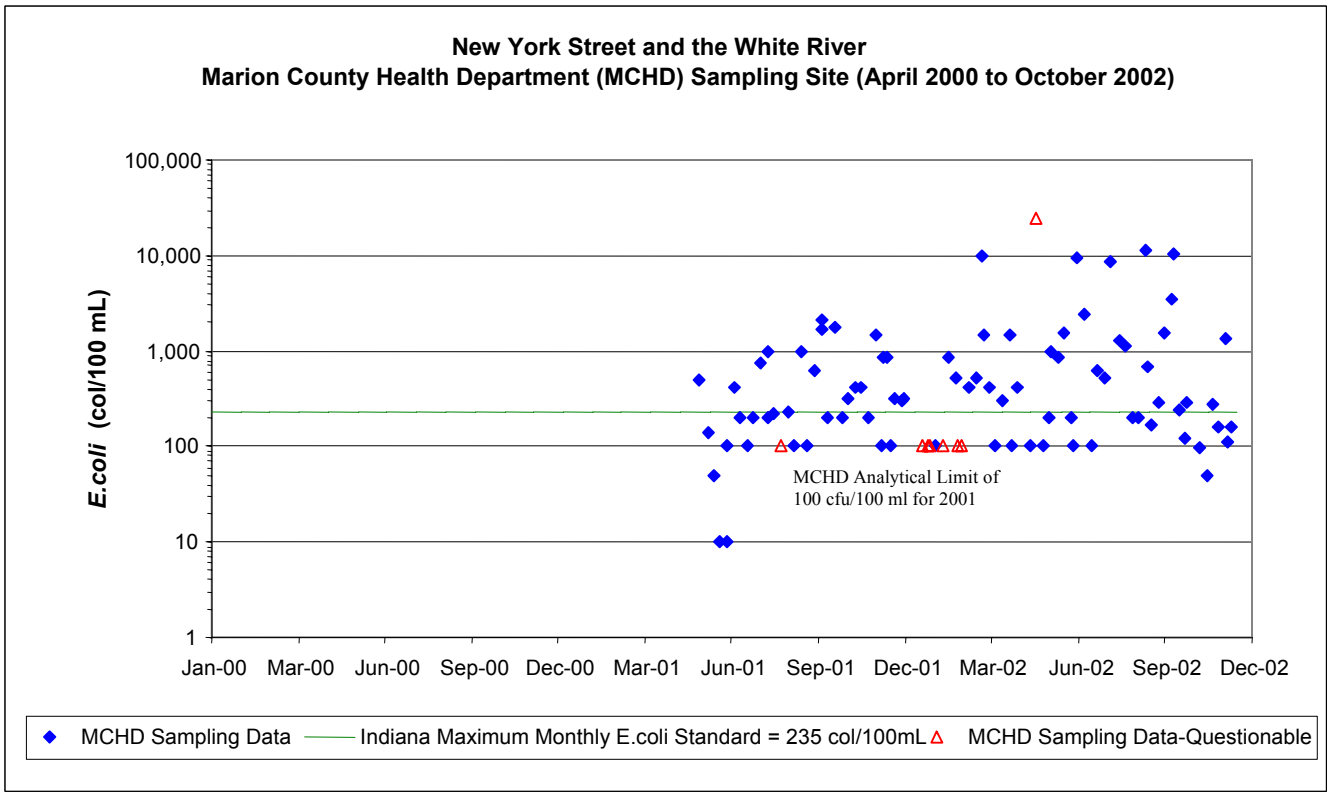
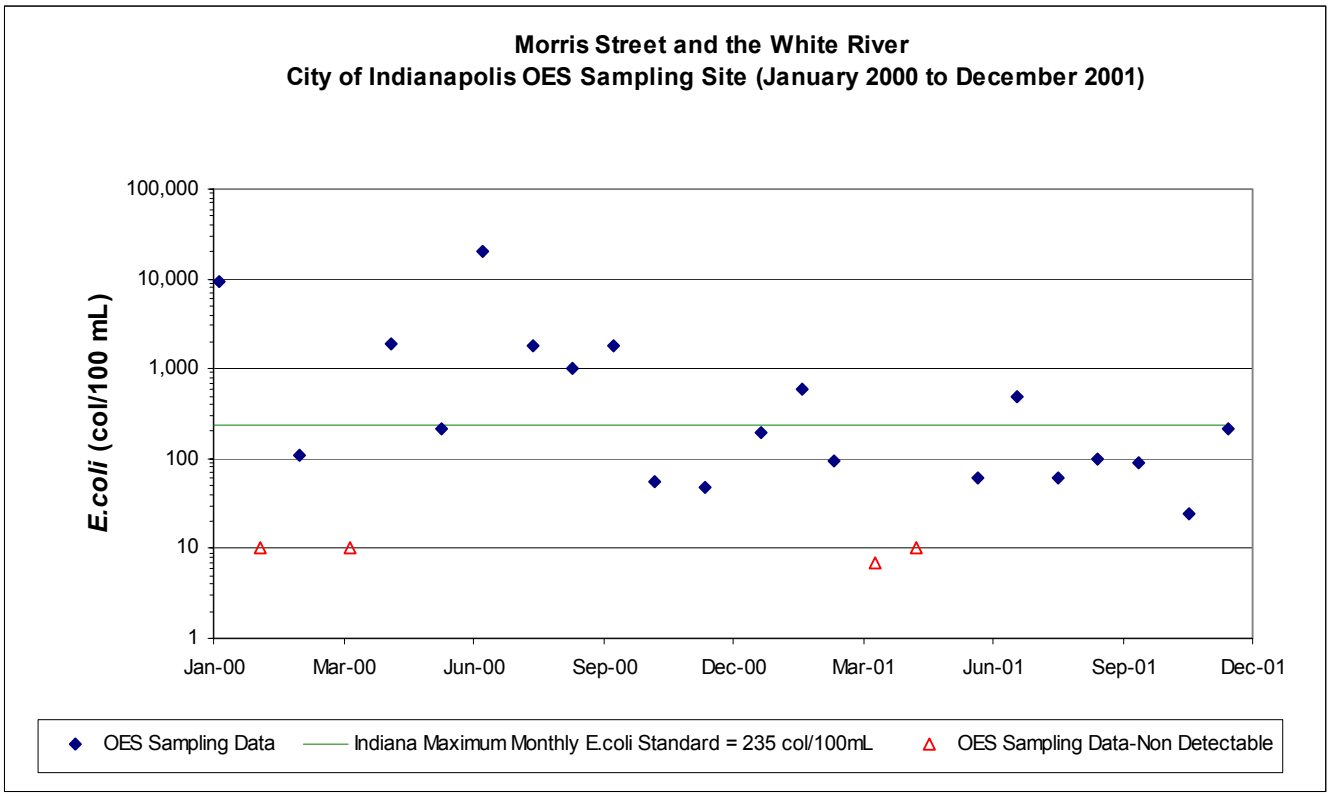


Figure 3.26: White River *E. coli* Data



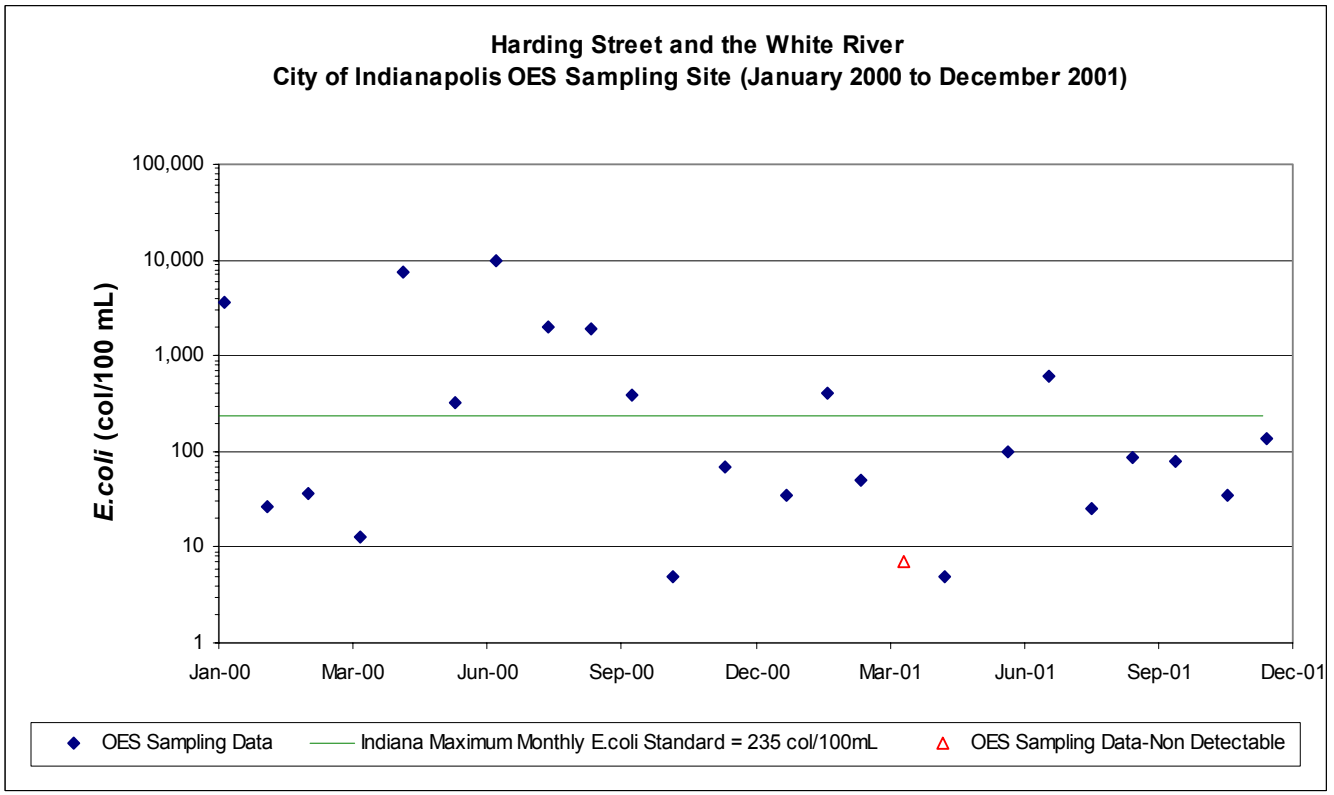
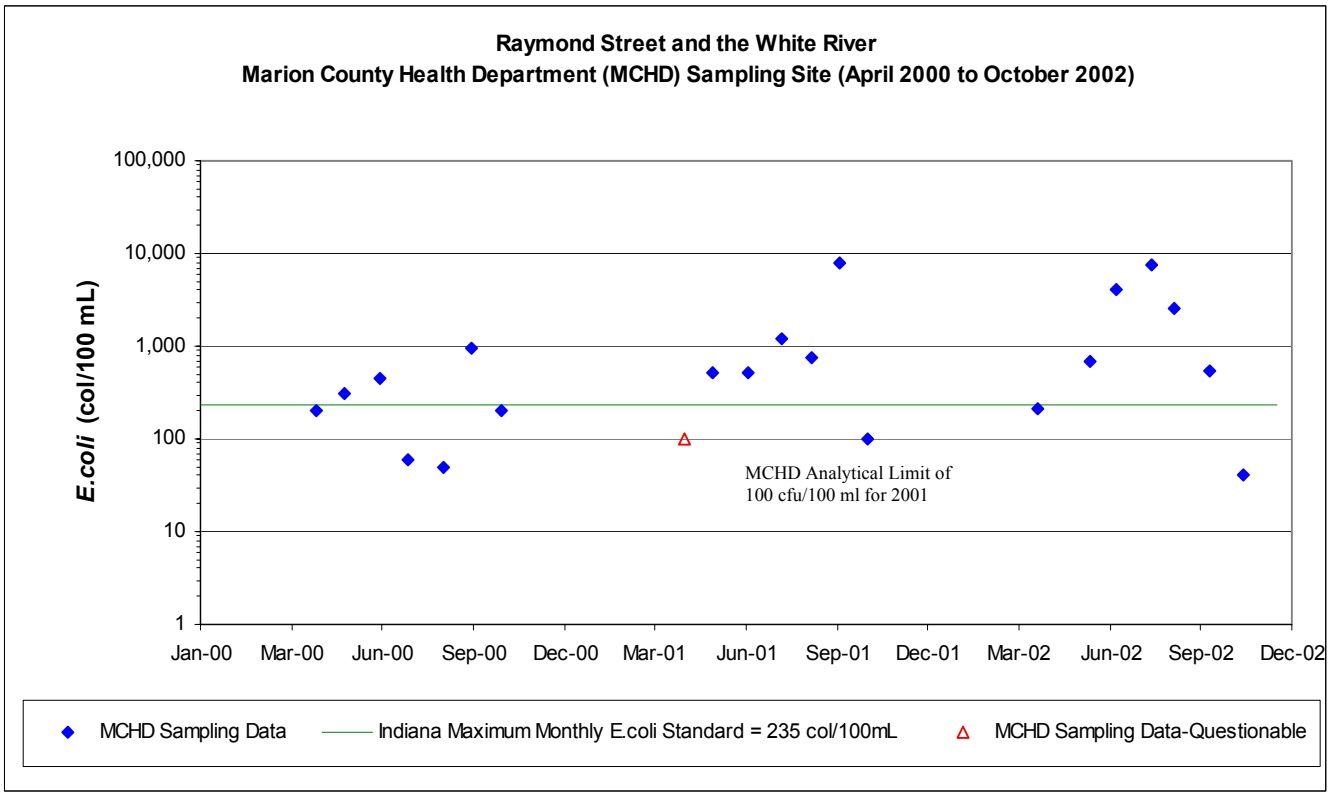


Figure 3.27: White River *E. coli* Data



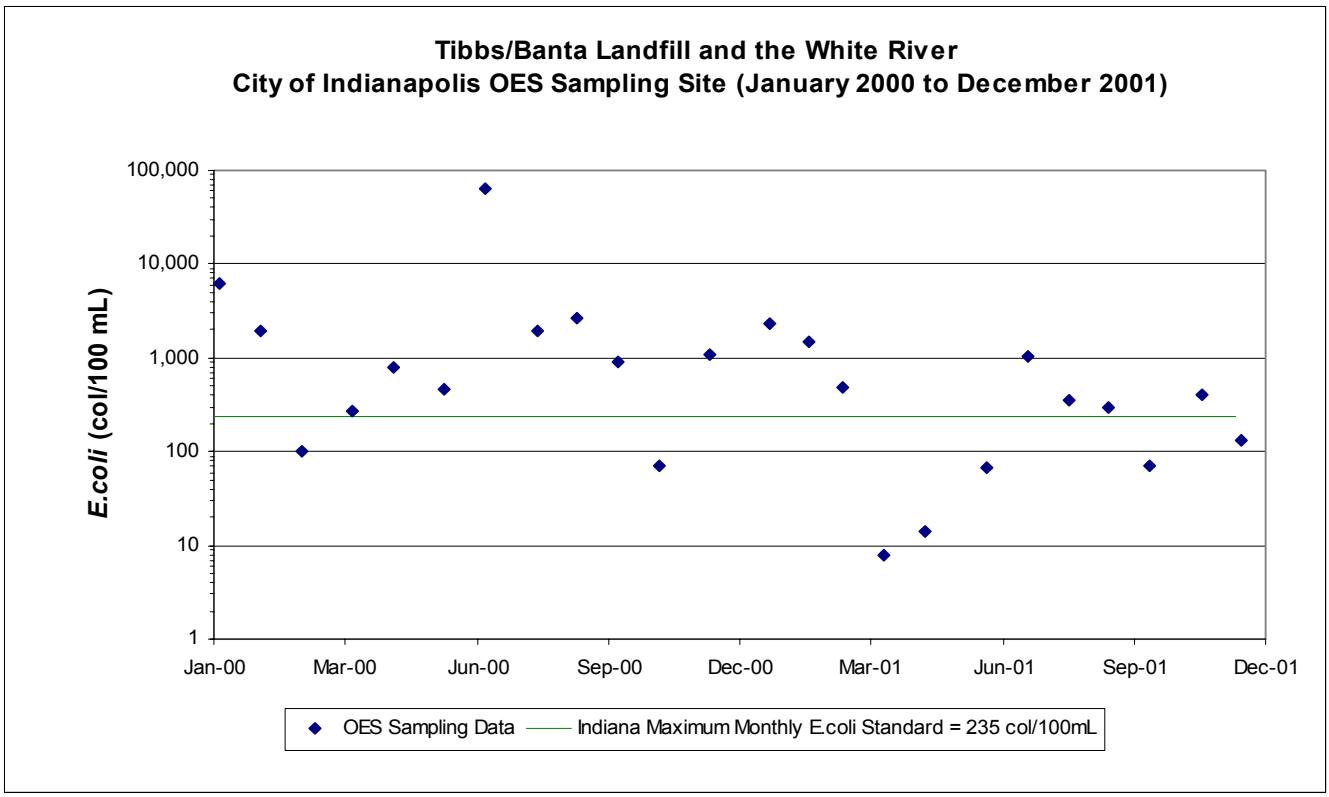
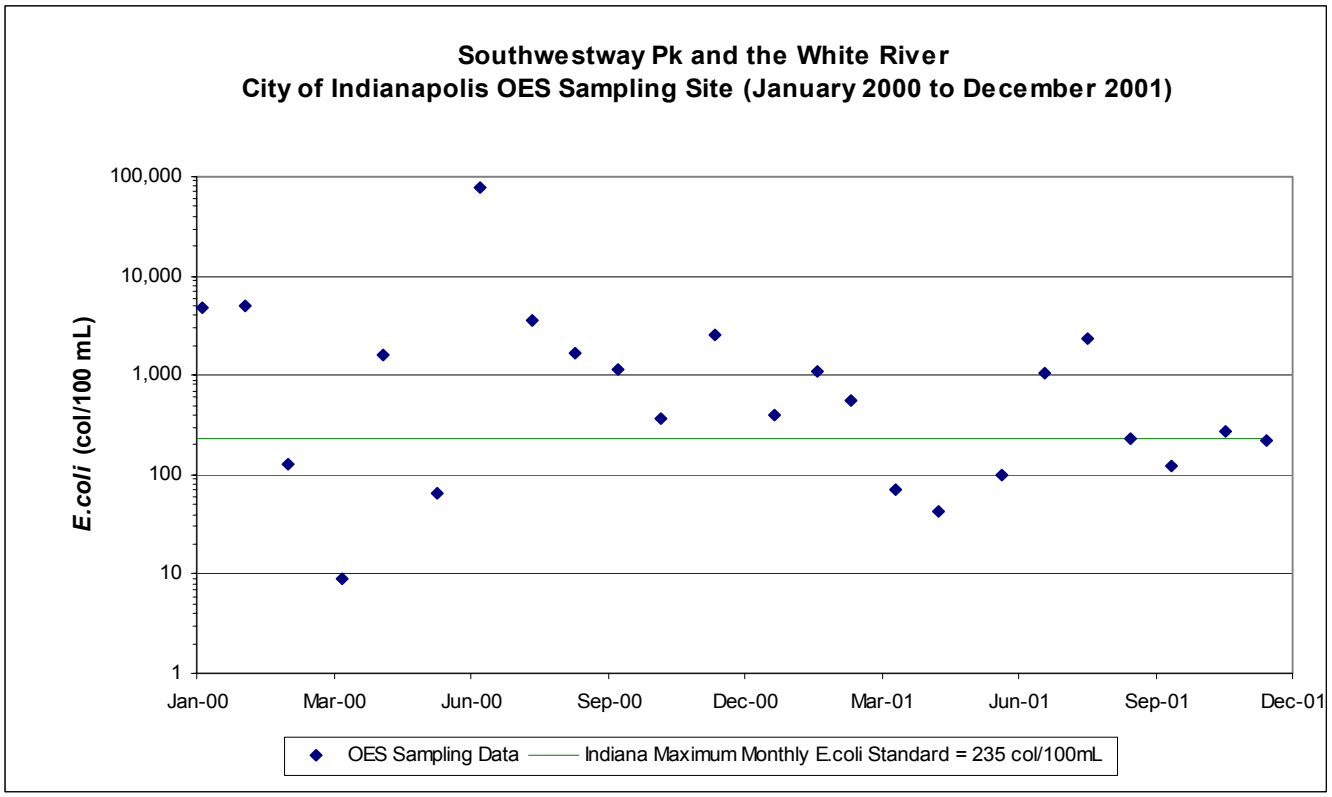


Figure 3.28: White River *E. coli* Data



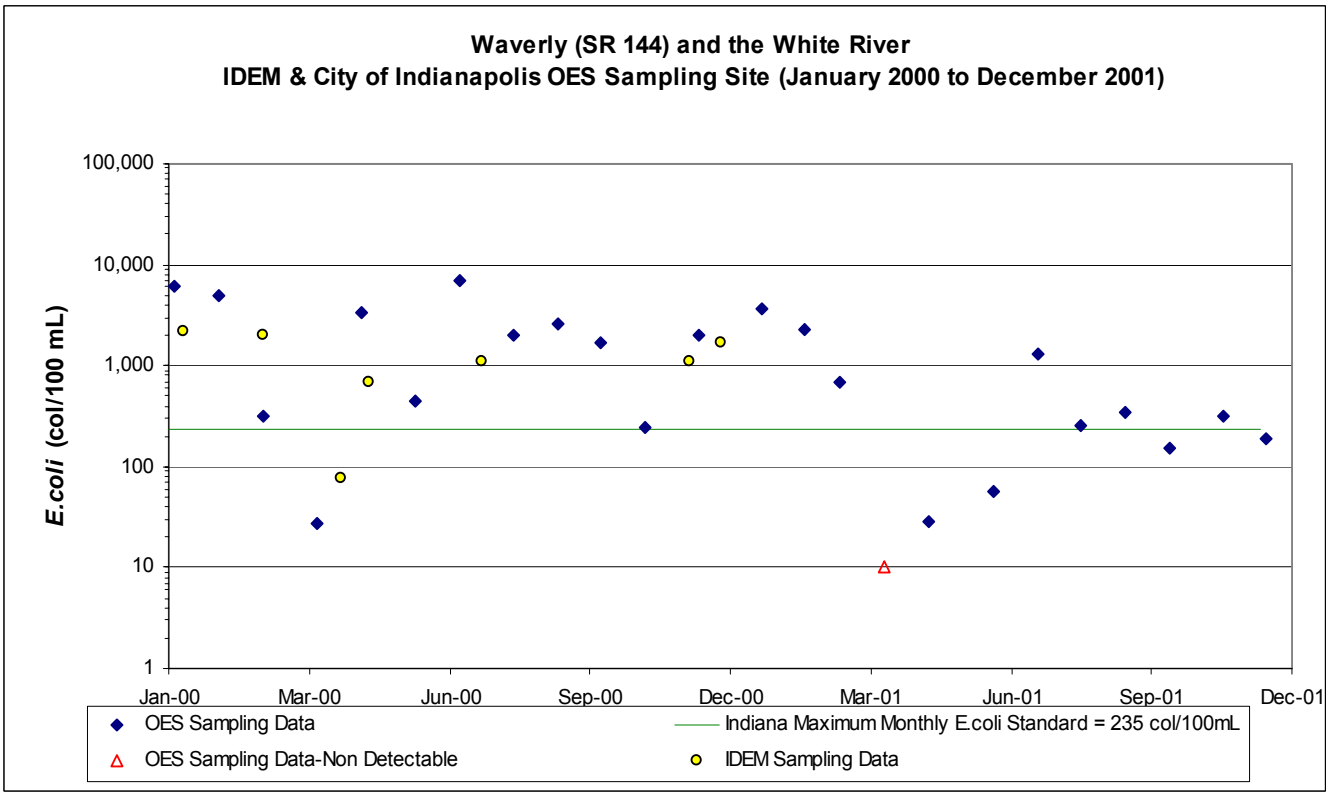
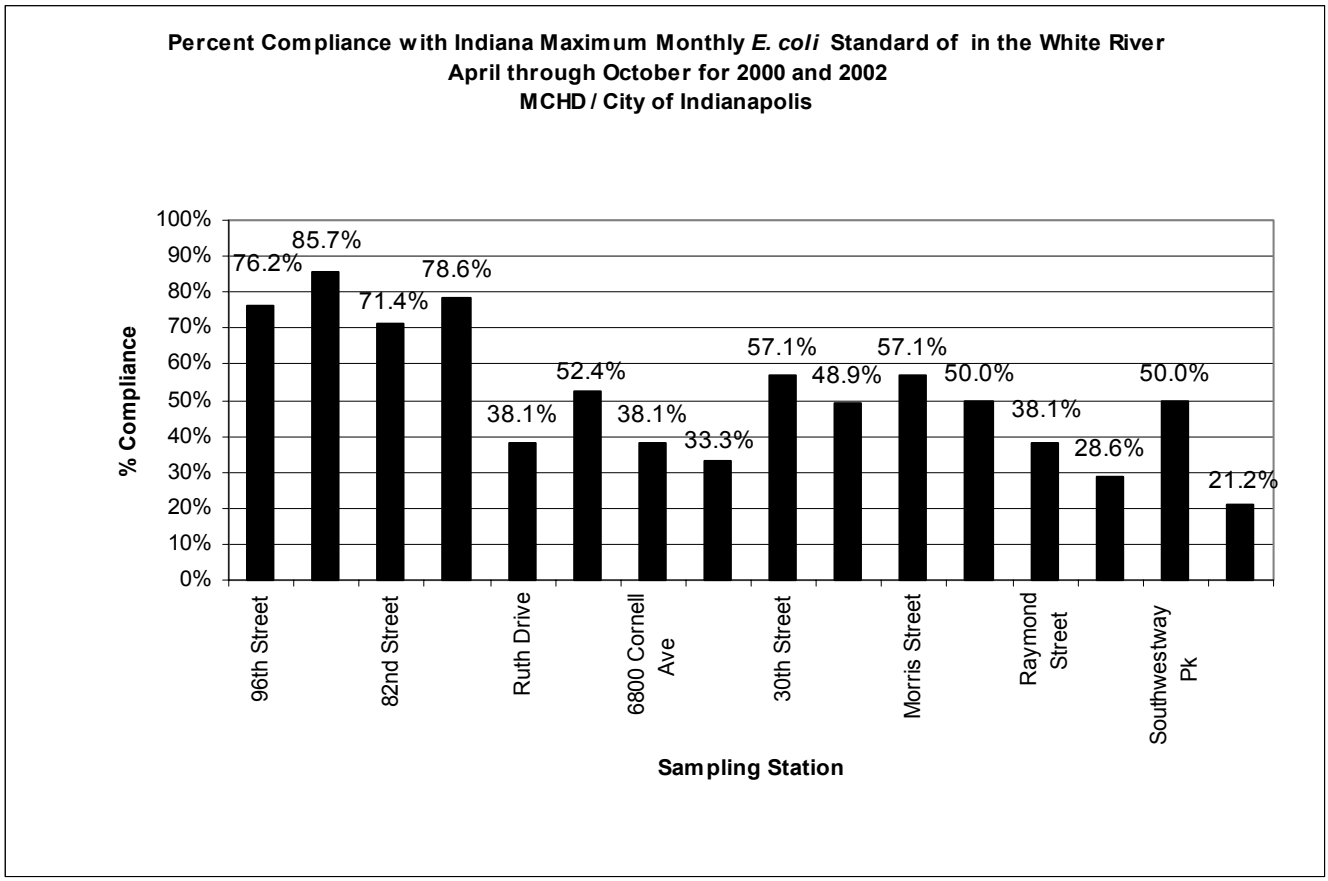
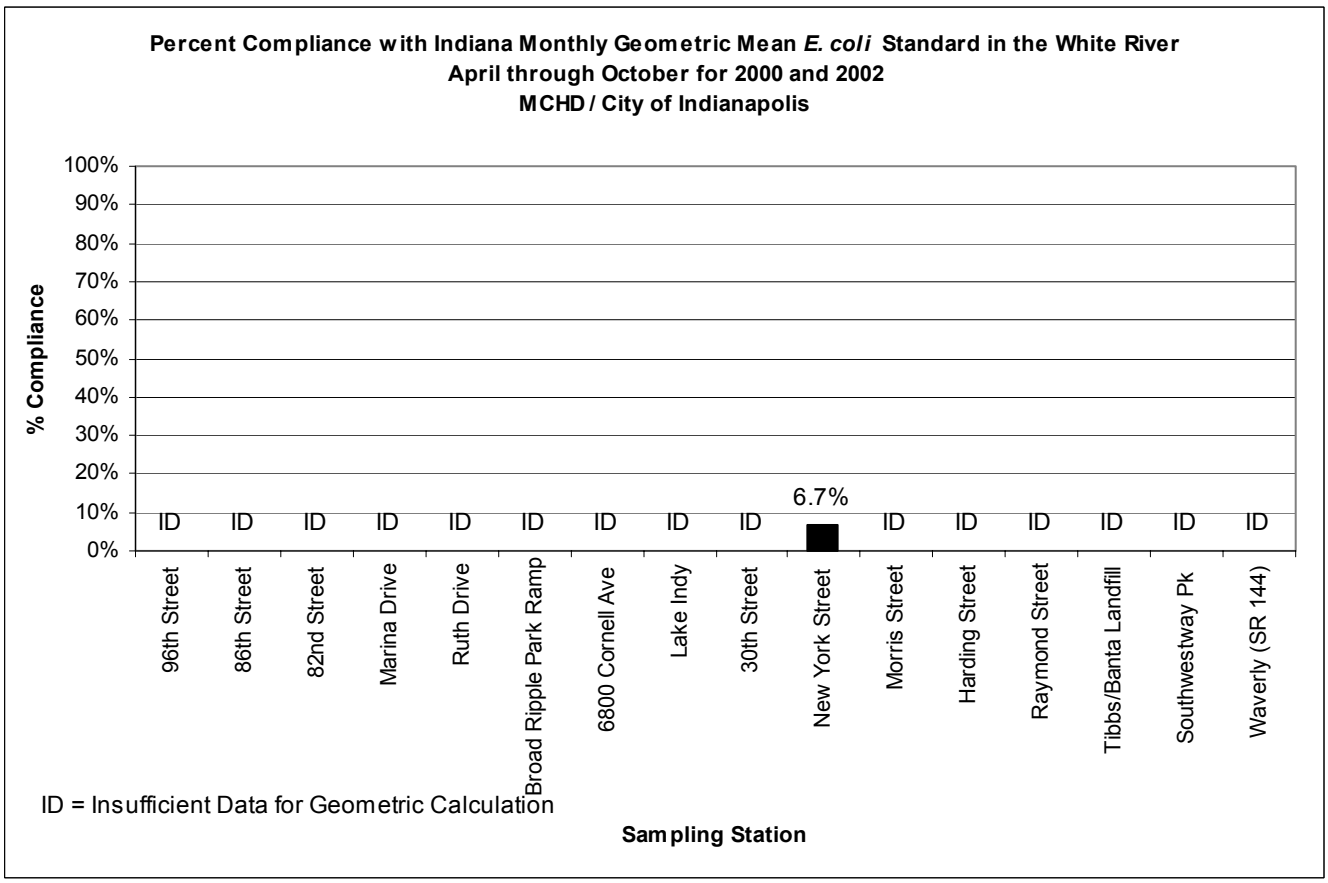


Figure 3.29: White River *E. coli* Data





Section 4
Water Quality Characterization

A watershed model was used to simulate the *E. coli* bacteria sources for both dry and wet weather sources. The model further breaks down wet weather *E. coli* sources into CSOs and urban/residential nonpoint sources. Additional work was performed to further define the sources of dry weather *E. coli* and the components of urban/residential nonpoint source wet weather contaminants.

The previous section documents the existing water quality for White River. The findings indicate that the *E. coli* bacteria standard of 125 cfu/100 ml (geometric mean of five samples collected over 30 days) and 235 cfu/100 ml (maximum day value) are often exceeded on the river.

4.1 Compliance Evaluation

The draft 2002 303(d) proposes to remove ammonia from the list. The findings indicate that the instream ammonia concentrations are below the new standard.

An earlier analysis indicated that the primary source of cyanide is the city's AWTs at Belmont and Southport. The instream water quality monitoring data supports this finding. Hence, control of cyanide is addressed through the NPDES permit associated with the AWTs.

Low dissolved oxygen which can exceed the instream water quality standard is caused by CSO discharges. The city's CSO Long Term Control Plan (LTCP) is being developed to reduce or eliminate the occurrence of low dissolved oxygen.

Based on the above, the remainder of this report will focus on the source assessment and load characterization of *E. coli* bacteria. *E. coli* bacteria data for 2000, 2001, and 2002 were analyzed for compliance with three reference criteria as follows:

- IDEM's geometric mean water quality standard for *E. coli* which is 125 cfu/100 ml or less,
- IDEM's 303(d) Listing Methodology (2002) guidance of no more than 10 percent of samples be above 235 cfu/100 ml, and
- IDEM's 303(d) Listing Methodology (2002) guidance of no sample having an *E. coli* level greater than 10,000 cfu/100 ml.

In order to better determine bacteria sources the data was separated into two categories, wet weather and dry weather. Wet weather is defined as precipitation (greater than trace amounts or greater than 0.1 inch) and three days following that precipitation. Dry weather is any time other than wet weather.

In addition, the White River was divided into three segments for analysis purposes.

- White River North -- Upstream Marion County line to Lake Indy (upstream of CSO area),
- White River CSO Area -- Lake Indy to Tibbs/Banta Landfill, and
- White River South -- Tibbs/Banta Landfill to Waverly (downstream of CSO area).

Table 4.1 and **Figure 4.1** show the study area extent of each river segment. The segment between the upstream Marion County Line to Lake Indy is considered upstream of the CSO area since the three CSOs that discharge within that area are only active an average of one time per year.

The findings of the compliance analysis are presented in **Table 4.2** for three segments on the White River for dry weather, wet weather and all weather. This information is presented graphically in **Figures 4.2 through 4.4**.

4.1.1 All Weather Analysis

All three river segments are not in compliance with the Indiana geometric mean standard of 125 cfu/100 ml , and the reference criteria of less than 10% of samples below 235 cfu/100 ml and no samples in excess of 10,000 cfu/100 ml. The analysis suggests that all segments of the White River are not able to accept the *E. coli* bacteria load from wildlife, septic, stormwater, and CSO sources. However, the White River upstream of Lake Indy is very close to the Indiana geometric mean standard of 125 cfu/100 ml.

4.1.2 Dry Weather

Two of the river segments, the White River upstream of Lake Indy and the CSO area, have geometric mean values lower than the Indiana geometric mean standard of 125 cfu/100 ml. However, neither stream is in compliance with the reference criteria of less than 10% of samples below 235 cfu/100 ml during dry weather. The analysis suggests that the White River through the CSO area has sufficient baseflow to absorb the *E. coli* load during a "typical" dry weather day, but frequent low flow conditions or fluctuations in the septic or wildlife loads occur more than 10% of the time during dry weather . The White River segment downstream of the CSO area is in excess of the Indiana geometric mean standard of 125 cfu/100 ml and the reference criteria of less than 10% of samples below 235 cfu/100 ml during dry weather. The analysis suggests that the stream receives excessive *E. coli* loadings from septic and wildlife sources.

4.1.3 Wet Weather

All of the river segments are in excess of all criteria during wet weather. The analysis suggests that all segments of the White river receive excessive *E. coli* loadings from stormwater and CSO sources. However, the number of samples in excess of 10,000 cfu/100 ml for the White River CSO area is an order of magnitude less than the for the

Fall Creek and Pleasant Run CSO areas during wet weather. This suggests that the White River possesses more baseflow to absorb the wet weather load. However, the % of samples in excess of 235 cfu/100 ml for the White River CSO area is comparable to the Fall Creek and Pleasant Run CSO areas.

Figure 4.1: White River - River Segments

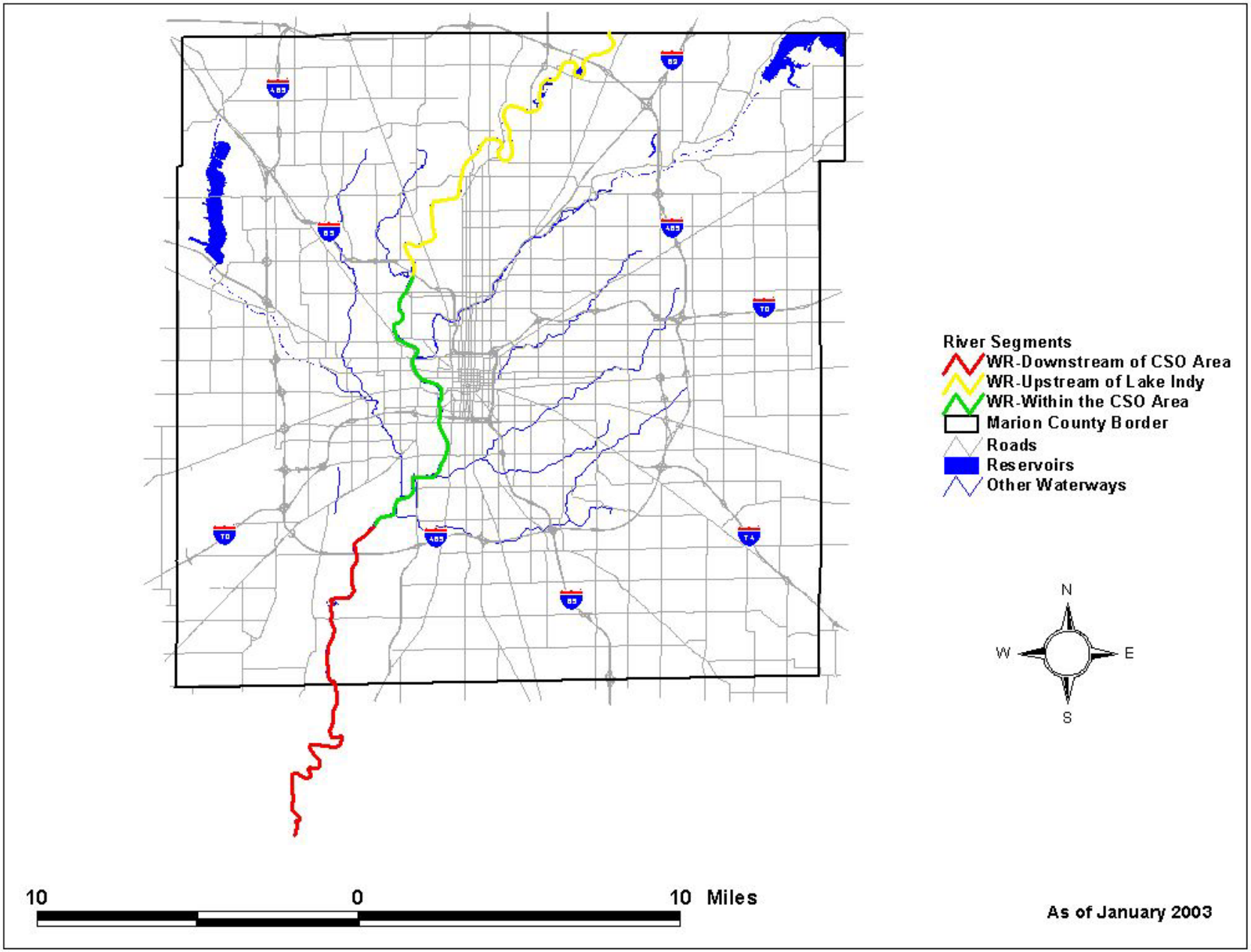


Figure 4.2: E. *coli* Bacteria Compliance
White River Upstream of Lake Indy
(Based on 2000 to 2002 Data)
City of Indianapolis
River Miles 251.7 to 235.6

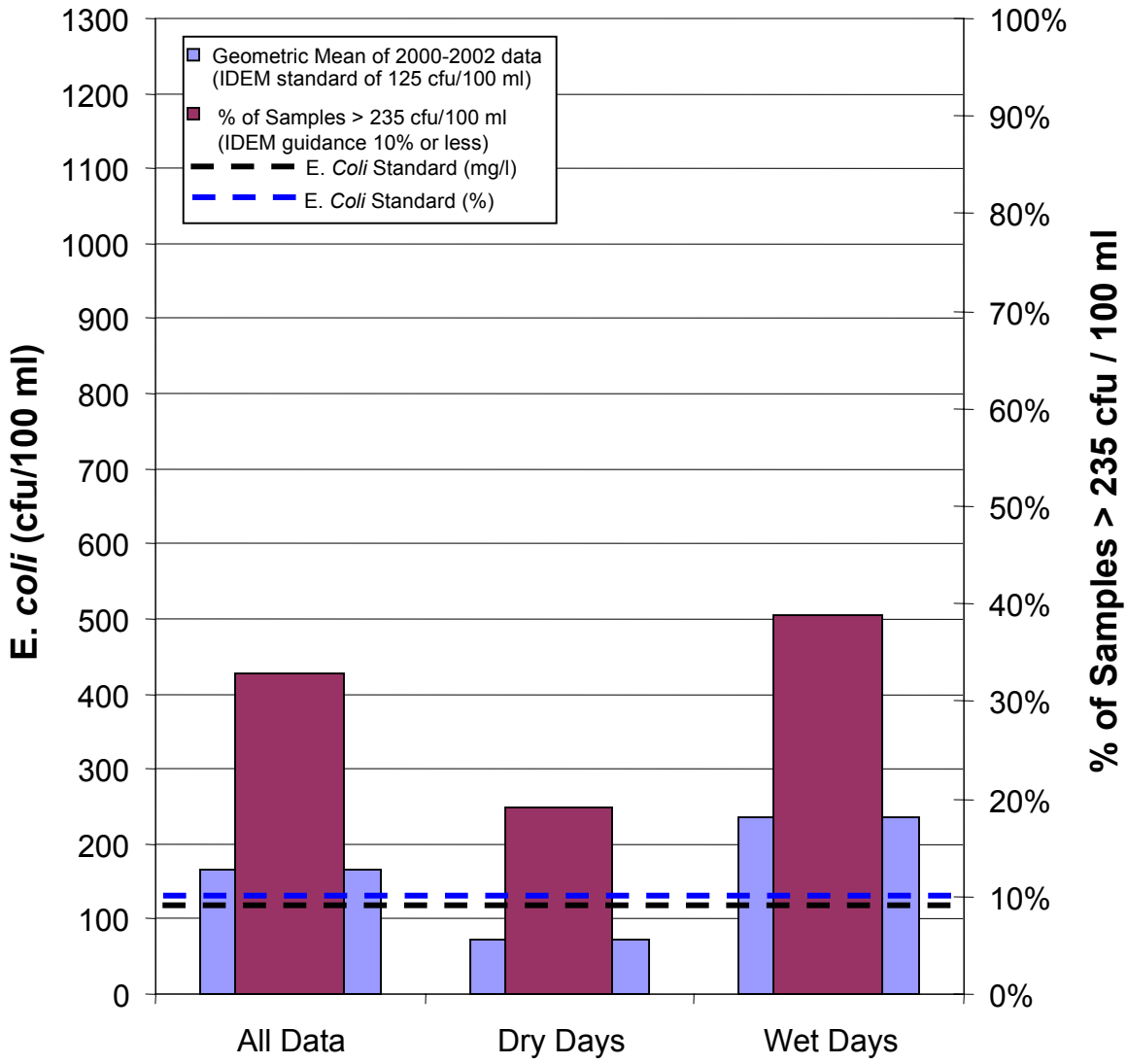


Figure 4.3: E. *coli* Bacteria Compliance
White River Within CSO Area
(Based on 2000 to 2002 Data)
City of Indianapolis
River Miles 235.6 to 225.1

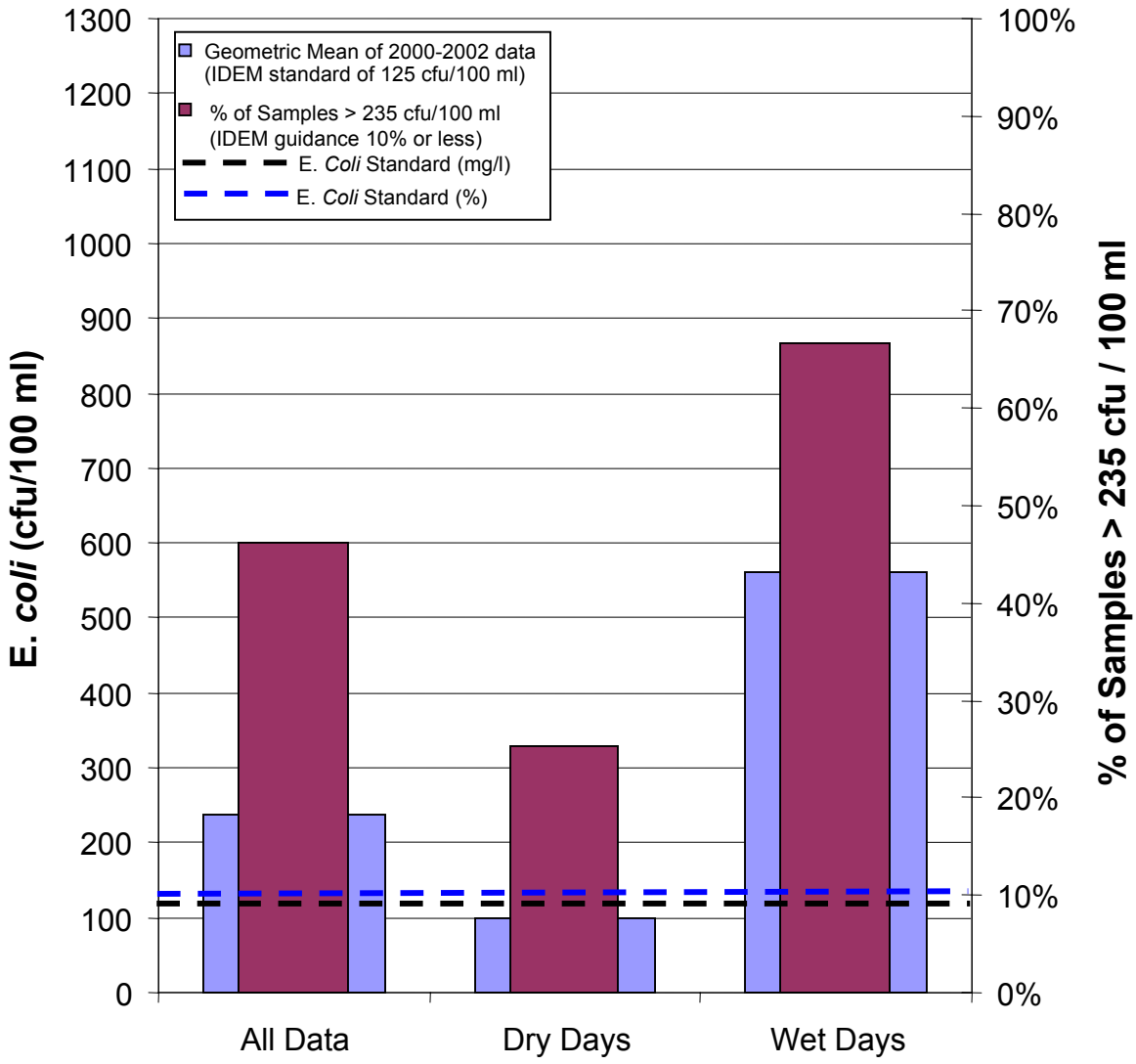


Figure 4.4: E. *coli* Bacteria Compliance
White River Downstream of CSO Area
(Based on 2000 to 2002 Data)
City of Indianapolis
River Miles 225.1 to 212

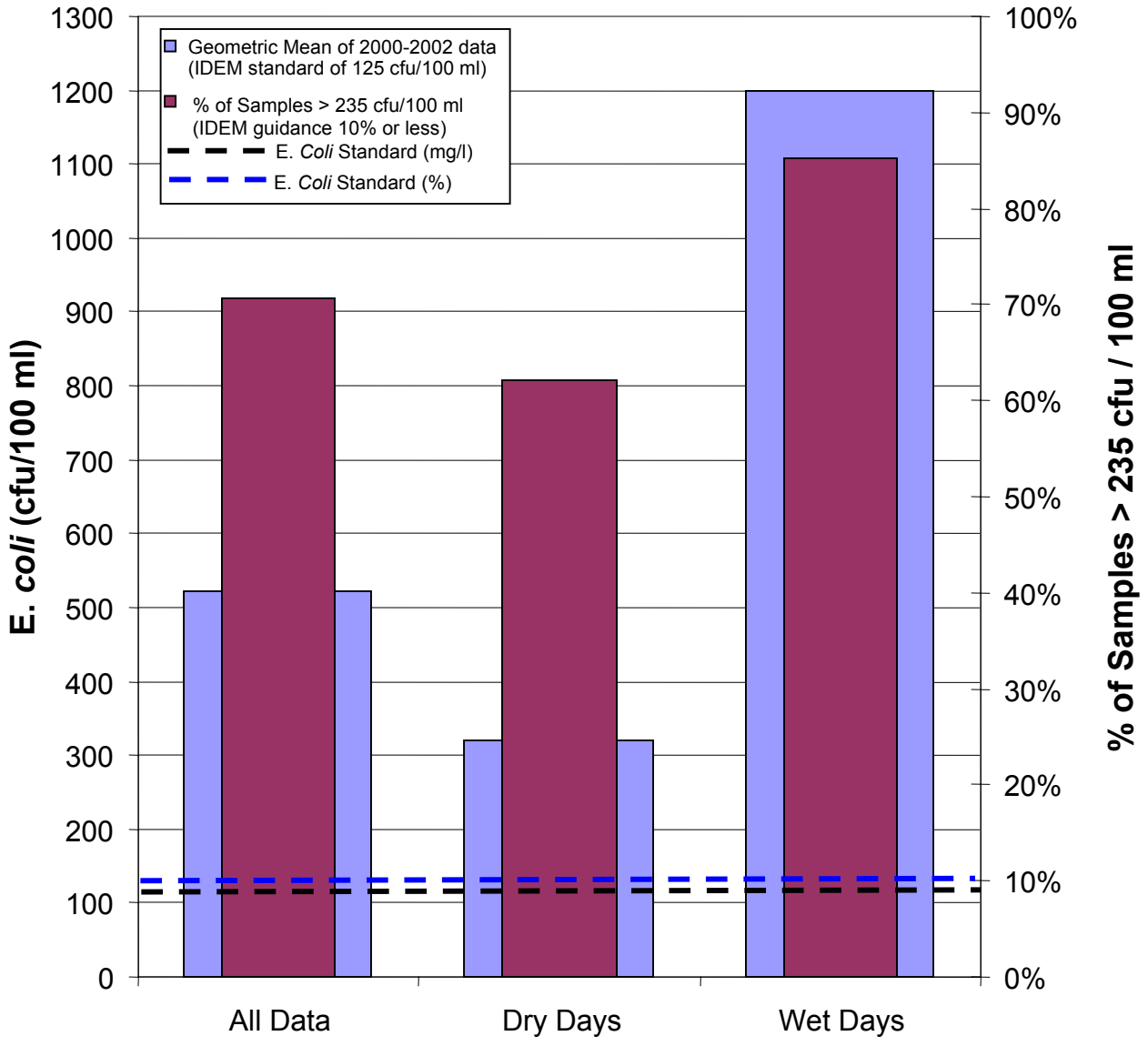


Table 4.1: Segment River Mile

River Segment	River Mile Start	River Mile End
White River - Upstream of Lake Indy	251.7	235.6
White River - Within CSO Area	235.6	225.1
White River - Downstream of CSO Area	225.1	212

Table 4.2: *E. coli* Bacteria Compliance

All Data				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
White River - Upstream of Lake Indy	166	32.9%	1	155
White River - Within CSO Area	238	46.2%	4	184
White River - Downstream of CSO Area	410	63.8%	2	47
Dry Weather				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
White River - Upstream of Lake Indy	74	19.1%	0	47
White River - Within CSO Area	99	25.3%	0	91
White River - Downstream of CSO Area	165	44.0%	0	25
Wet Weather				
River Segment	**Geometric Mean of 2000-2002 data**	**% of Samples > 235 cfu/100 ml**	**Number of Samples > 10,000 cfu/100 ml**	**Total Number of Samples**
White River - Upstream of Lake Indy	236	38.9%	1	108
White River - Within CSO Area	561	66.7%	4	93
White River - Downstream of CSO Area	1159	86.4%	2	22
State Guidance[1]	**(IDEM standard of 125 cfu/100 ml)**	**(IDEM Guidance 10% or less)**	**(IDEM Guidance None > 10,000 cfu/100 ml)**	

[1] Indiana's 303(d) Listing Methodology for Impaired Waterbodies and Total Maximum Daily Load - September 2002

Section 5
Source Characterization

A source assessment is used to characterize the known and suspected sources of *E. coli* bacteria in the watershed for use in the water quality model and development of the TMDL. Using the watershed model, the *E. coli* bacteria for this TMDL was characterized for the following sources:

- Septic systems
- Illicit connections to storm drains
- Advanced Wastewater Treatment plants
- Wildlife/Natural
- Stormwater runoff
- Combined sewer overflows
- Upstream sources

The source assessment evaluated the type, magnitude, timing, and location of pollutant loading to the impaired water bodies for *E. coli* bacteria. The relative rankings of the pollutant contribution for each parameter were established based on the available source data.

5.1 Septic Systems

Failing septic systems have been linked to increased *E. coli* bacteria levels in streams throughout the world. In accordance with the City of Indianapolis' Barrett Law program, a list of neighborhoods with failing septic systems is kept and updated based on new information. Scheduling of sewer projects in each neighborhood is partially based on the degree of system failure that is observed. Priority levels 1 through 3 are assigned with Priority 1 corresponding to neighborhoods with the highest degree of failure. The failure information was obtained for the period of 2000 through 2002 and was compared to sampling data for that same period.

As of early 2000, there was one Priority 1 septic neighborhood within the watershed boundary that directly drains into the White River within Marion County, as well as 15 Priority 2 and 20 Priority 3 septic neighborhoods. For areas draining into one of the tributary streams, there are approximately 30 Priority 1 septic neighborhoods, 22 Priority 2 septic neighborhoods, and 26 Priority 3 septic neighborhoods. The number of septic systems in each watershed was estimated based on the city's GIS data for septic neighborhoods, buildings, and watersheds. *E. coli* bacteria loads were estimated based on an assumed failure rate, flow rate, and *E. coli* counts for the septic neighborhoods. For purposes of the TMDL analysis, the failure rate for septic systems was related to the priority level of the neighborhood as follows:

- Priority 1: 25% failure rate

- Priority 2: 15% failure rate
- Priority 3: 10% failure rate
- All others: 5% failure rate

A flow of 100 gallons/person-day and a concentration of 10,000 cfu/100 ml (Horsley and Whitten, 1996) for each failing septic system were assigned. Leaking septic systems are included in the water quality model as a point source having constant flow and concentration. The loading rate attributed to leaking septic systems is estimated to be 4.66×10^{10} cfu per day. **Table 5.1** summarizes the estimated septic *E. coli* bacteria loadings into White River.

5.2 Illicit Connections

Stormwater outfalls often carry *E. coli* during dry weather because of loadings from illicit sanitary connections to the stormwater collection system. The City of Indianapolis Fifth Annual Report (2002) (AMEC, 2003) reported that approximately 7.7% of the stormwater outfalls sampled contained dry weather flows. For each illicit discharge, a flow of 20 gpd with 10,000 cfu/100 ml for *E. coli* bacteria was assigned. **Table 5.2** summarizes the estimated illicit storm drain *E. coli* loadings into White River.

5.3 Wildlife and Natural Background

Not all *E. coli* bacteria in waterways are the result of man-made sources. Wildlife, both instream and on-bank, can be a source of *E. coli* bacteria to the streams. To estimate the potential load from wildlife, the instream monitoring station at 71st Street on Fall Creek was utilized. The land use above 71st Street on Fall Creek indicates natural conditions with few anthropogenic sources. Please consult the Fall Creek TMDL Report (CDM, 2003) for more information. The *E. coli* bacteria monitoring data from this station was used to represent the wildlife or natural *E. coli* bacteria load into the streams. **Table 5.3** summarizes the estimated *E. coli* concentrations and loadings into White River that are a result of natural biota in the watersheds. All *E. coli* concentrations shown in the table received adjustment during model calibration.

5.4 Stormwater Runoff

Stormwater often carries *E. coli* because of loadings from domestic animals, wildlife, and agricultural land. Information from the City of Indianapolis' stormwater program and GIS coverages provided insight into the contribution of stormwater to the *E. coli* exceedances seen in Fall Creek and Pleasant Run and showed what progress has been made thus far in alleviating that contribution. Due to variations in solid deposits in residential, commercial, and other property types, a range of *E. coli* concentrations were assumed for each land use. Average stormwater *E. coli* counts were estimated from IMAGIS land use and watershed coverages. These counts were applied to daily surface runoff flows from October 1991 to October 2001 as predicted

using the city's watershed model. **Table 5.4** contains a summary of the average daily surface runoff flows and *E. coli* loadings into White River based on land use. **Table 5.5** shows the percentages of stormwater loads into White River that come from permitted (storm drain outfall), non-permitted (surface runoff), and out-of-county sources. This information is pertinent to the TMDL analysis as the city's stormwater programs only address the control of stormwater *E. coli* from sources within the county.

5.5 Advanced Wastewater Treatment Plants

As a requirement of the City of Indianapolis AWT plants' NPDES permits, the treatment plant influent and effluent is monitored for *E. coli* bacteria. **Table 5.6** summarizes the estimated *E. coli* loadings into the White River from the Belmont and Southport AWTs.

5.6 Combined Sewer Overflows

Combined sewer overflows (CSOs) can be a large source of *E. coli* in urban streams. The CSO flows and *E. coli* bacteria loadings were determined using a methodology similar to that being used for the CSO Control Technologies Evaluation (CDM, 2003) in the CSO LTCP. CSO discharges were predicted by the city's collection system model for a ten-year period of time (October 1991 to October 2001). *E. coli* sampling of CSO discharges were performed by the city in 2001 to characterize CSO discharges. Concentrations ranged from 500,000 cfu/100 ml up to 900,000 cfu/100 ml. The CSO flows and *E. coli* loads were predicted using the city's models and sampling data. **Table 5.7** contains a summary of the estimated *E. coli* loadings from CSOs on White River and to the tributaries of the White River.

5.7 Out of County *E. coli* Contributions

In addition to the in-county sources discussed above, the White River receives *E. coli* bacteria from various sources in Hamilton County and the watershed north. For the purposes of this analysis, the upstream loadings were assumed constant for dry weather and wet weather flow conditions, and are summarized in **Table 5.8**.

TABLE 5.1: FAILING SEPTIC SYSTEMS
WHITE RIVER

Watershed	Approximate Count of Septic Systems				Total Septics	Estimated Failing Septic Systems	Approximate Population	Estimated Failing Septic Flow (MGD)	Estimated Failing Septic Daily Load (cfu)	Estimated Failing Septic Monthly Load (cfu)
	Barrett Law Priority 1	Barrett Law Priority 2	Barrett Law Priority 3	Non-Barrett Law						
Howland & Johnson Ditch	0	130	1044	0	1174	124	434	0.04	1.64E+10	4.92E+11
Crooked & Williams Creek	908	8	840	44	1800	314	1100	0.11	4.17E+10	1.25E+12
White River North	0	867	1614	78	2559	295	1034	0.10	3.91E+10	1.17E+12
Eagle & Guion Creek***	158	433	563	78	1232	165	576	0.06	2.18E+09	1.64E+11
White River CSO	0	667	430	215	1312	154	538	0.05	2.04E+10	6.11E+11
State Ditch, Buck & Lick Creek****	1188	1416	838	1162	4604	651	2280	0.23	2.16E+10	6.47E+11
White River South	108	620	612	253	1593	194	678	0.07	2.57E+10	7.70E+11
Assumed Failure Rate	**25%**	**15%**	**10%**	**5%**						
Totals	**2362**	**4141**	**5941**	**1830**	**14274**	**1897**	**6640**	**0.66**	**1.67E+11**	**5.11E+12**

*Assumptions include 3.5 persons per septic system, 100 gpcd septic flow, and 10,000 cfu/100 ml E. coli in the septic flow
**Persons per system and per capita flows taken from May 1989 DPW Design Standards
***Considered a secondary input with reduced loading into the White River CSO Reach(1,000 cfu/100 ml E. coli in septic flow)
****Considered a secondary input with reduced loading into the White River South Reach(2,500 cfu/100 ml E. coli in septic flow)

TABLE 5.2: ILLICIT CONNECTIONS TO STORM DRAINS
WHITE RIVER

Watershed	# of Storm Outfalls	Miles of Storm Sewer and Drains	Approximate number of Illicit Connections	Illicit Flow (MGD)	Estimated Illicit Connection Daily Load (cfu)	Estimated Illicit Connection Monthly Load (cfu)
White River North	29	131	2	4.00E-05	1.51E+07	4.54E+08
White River CSO	150	119	12	2.40E-04	9.08E+07	2.73E+09
White River South	20	152	2	4.00E-05	1.51E+07	4.54E+08
Howland Ditch	Included in White River North Summary					0.00E+00
Crooked Creek & Johnson Ditch	123	196	9	1.80E-04	6.81E+07	2.04E+09
Williams Creek	59	72	5	1.00E-04	3.79E+07	1.14E+09

*Illicit Connections for each stream segment assumed at 7.7% of outfalls (based on 2002 NPDES Stormwater report sampling data)
20 gpd sanitary flow, and 10,000 cfu/100 ml E. coli in the illicit flow

TABLE 5.3: INSTREAM WILDLIFE
WHITE RIVER

Watershed	Average Dry-Weather E. coli (cfu/100 ml)	Average Dry-Weather stream flow (cfs)	Approximate Instream Wildlife Daily Load (cfu)	Estimated Instream Wildlife Monthly Load (cfu)
Crooked Creek*	25	19.4	1.19E+10	3.56E+11
White River North*	33	91	7.31E+10	2.19E+12
White River CSO*	5	78	9.49E+09	2.85E+11
White River South*	48	546	6.41E+11	1.92E+13

*The 71st Street Sampling Station along Fall Creek is not in close proximity to any septic systems. Its dry-weather observed E. coli bacteria concentrations are assumed to be the result of wildlife. This concentration is applied to all other streams

*These concentrations received adjustment during model calibration. Calibrated concentrations are shown.

TABLE 5.4: STORMWATER RUNOFF FROM SEPARATE SEWER AREAS
WHITE RIVER

	Approximate Percentage of Specified Land use								Approximate Average E. Coli Concentration (cfu/100 ml)	Daily Average Stormwater Flow (cfs)	Daily Average Stormwater Load (cfu)
Land use Type	Commercial	Residential	Historic & Hospital	Industrial	Parks	Highway ROW	Spec. Uses	University			
Zoning Class	All C's	All D's	All H's	All I's	All PK's	ROW, RC	All SU's	All U's			
Assumed E. coli concentration	2000	2250	2500	2000	2500	3000	2500	2000			
White River Upstream	12%	68%	3%	4%	2%	2%	9%	0%	2300	81	4.54E+12
White River CSO	8%	48%	1%	22%	7%	3%	8%	4%	2200	35	1.90E+12
White River South	5%	67%	0%	12%	2%	1%	13%	0%	2300	22	1.24E+12

TABLE 5.5: UNPERMITTED AND PERMITTED STORMWATER RUNOFF SOURCES
WHITE RIVER

Watershed	Permitted Storm Sewer Area (Acres)	Area without Storm Sewers (Acres)	Area outside County (Acres)	Total Area (Acres)	% Permitted	% Unpermitted	% Out of County
White River North*	24,000	-	254,000	278,000	9%	0%	91%
White River CSO**	12,000	3,000	-	15,000	80%	20%	0%
White River South***	43,000	9,000	-	52,000	83%	17%	0%

*Includes Howland & Johnson Ditch, Crooked Creek & Williams Creek
**Includes Eagle & Guion Creek
***Includes State Ditch, Lick Creek, and Buck Creek

TABLE 5.6: AWT TREATED EFFLUENT
WHITE RIVER

Watershed	AWT Discharge	Average Discharge Flow (MGD)	Average E. coli Concentration (cfu/100 ml)	Average Daily AWT Load (cfu)	Average Monthly AWT Load (cfu)
White River CSO	Belmont	96	30	1.26E+11	3.77E+12
White River South	Southport	79	52	1.60E+11	4.79E+12

*E. Coli discharges not monitored from Jaunary to March
*AWT data recorded from April through October 2002 MOR's

TABLE 5.7: COMBINED SEWER OVERFLOWS
WHITE RIVER

Watershed	# Of CSO Regulators	# of CSO Outfalls	Annual Average CSO Volume (MG)	Average CSO E. Coli Concentration (cfu/100 ml)	Annual Average CSO E. Coli Load (cfu)	Daily Average CSO E. Coli Load (cfu)	Monthly Average CSO E. Coli Load (cfu)
Fall Creek CSO	35	26	1713	9.33E+05	4.02E+16	1.10E+14	3.30E+15
Pleasant Run CSO	51	51	334	1.21E+06	1.51E+16	4.13E+13	1.24E+15
White River CSO	35	26	1110	1.01E+06	5.23E+16	1.43E+14	4.30E+15
Pogues Run CSO	24	23	1046	1.28E+06	4.67E+16	1.28E+14	3.84E+15
Eagle Creek CSO	N/A	N/A	66	7.19E+05	2.05E+15	5.62E+12	1.69E+14

*Flows and bacteria loadings are from the 50-year rainfall record Flows and loads presented are model results.
**White River regulator and outfall counts include Eagle Creek

TABLE 5.8: HAMILTON COUNTY FLOW
WHITE RIVER

Watershed	Average E. coli (cfu/100 ml)	Average stream flow (cfs)	Approximate Hamilton Co. Daily Load (cfu)	Estimated Hamilton County Monthly Load (cfu)
Hamilton County -- Dry*	60	229	3.36E+11	1.01E+13
Hamilton County -- Wet**	186	229	1.04E+12	3.13E+13

*The dry-weather geometric mean of the 96th street sampling station was assumed to be the Hamilton Co. dry-weather concentration
*This concentration was later adjusted to match observed daily data
**The wet-weather gemetric mean of the 96th street sampling station was assumed to be the Hamilton Co. wet-weather concentration

Section 6
Total Maximum Daily Load Analysis

A TMDL is a tool for meeting water quality standards. It is based on the relationship between sources of pollutants and instream water quality conditions. The TMDL establishes the allowable loadings for specific pollutants that a water body can receive without exceeding water quality standards, thereby providing the basis for establishing water quality based pollutant controls.

6.1 Goals

Using the U.S. EPA *Protocol for Developing Pathogen TMDLs* (January 2001), the following steps were followed and utilized to develop a TMDL for each parameter:

- **Problem identification**: Identify key factors and background information for water body that describe the nature of the impairment.
- **Water quality indicators and targets**: Identify numeric indicators and target values that can be used to evaluate attainment of water quality standards.
- **Source assessment**: Identify and characterize sources of pollutant to water body.
- **Linkage between water quality targets and sources**: Linkage establishes the cause and effect relationship between the pollutant sources and the instream water quality response. The linkage is further used to estimate the load assimilation capacity of the water body, which is the maximum amount of pollutant loading a water body, can assimilate and still attain water quality standards.
- **Load allocation**: Based on the established target/sources linkage, pollutant loadings that will not exceed the load assimilation capacity and will lead to attainment of the water quality standard can be determined.
- **Assembling the TMDL**: The elements of a TMDL submittal are compiled to facilitate TMDL review.

  The final step in the TMDL process will occur in the near future.

- **Follow-up monitoring and evaluation**: After implementation of the TMDL, follow-up monitoring is used to assess if the TMDL results in attaining water quality standards for the water body.

6.2 Methods

A watershed model of the White River from Marion County downstream to Waverly was developed and calibrated to the existing instream *E. coli* bacteria data. The model simulated the daily instream bacteria counts for each stream segment based on loads from the sources described in Section 5. For the dry weather sources, a constant load

was applied, whereas for stormwater runoff and CSO discharges, the *E. coli* bacteria load was based on the city's separate sewer area water quality model for stormwater and the collection system interceptor hydraulic model for CSO discharges during wet weather. A ten-year period of time (October 1991 through September 2001) was simulated. Data on stream flow was used to predict the resultant instream *E. coli* bacteria counts for each day for the ten-year period.

Daily flow data for the White River – Indianapolis and Stout stations was obtained from the USGS for the period of October 1, 1991 through September 30, 2001. This flow data was used for the daily *E. coli* model.

Table 6.1 presents a sample page from the daily *E. coli* bacteria model for the White River CSO area. **Figure 6.1** presents the predicted instream bacteria counts for April 1, 1997 to October 31, 1997 for the White River CSO Area. **Figure 6.2** presents the predicted instream bacteria counts for April 1, 1997 to October 31, 1997 for the White River South reach.

Model calibration consisted of comparisons of the geometric mean, percent of samples over 235 cfu/100 ml, and the number of samples over 10,000 cfu/100 ml per year of sampling. These comparisons were performed for both dry weather and wet weather data. The calibration of the mass balance model for *E. coli* bacteria included quality checks of the USGS daily flow data, adjustment for *E. coli* contributions from wildlife for all reaches, adjustment for the Pleasant Run septic flow *E. coli* contributions, and for *E. coli* bacteria contributions from stormwater. **Table 6.2** contains a summary of the observed and modeled *E. coli* bacteria loading parameters for the three watersheds modeled from October 1991 through September 2001. The percentage of observed and predicted days in excess of 235 cfu/100 ml for dry, wet, and all weather conditions is reported in the table. **Table 6.3** summarizes the daily septic, illicit connections, wildlife, stormwater, and CSO *E. coli* bacteria loadings into the White River.

6.3 Load Allocation

After establishing the pollutant sources and the relationship between pollutant sources and instream water quality, a load allocation (reduction) was developed to achieve the numeric target value for each parameter. However, there are numerous combinations of load reduction scenarios that all achieve the target value for each parameter.

The allowable TMDLs for the White River are presented below.

- White River North -- **1.04×10^{12} cfu**, which requires an 82% reduction in the average daily bacteria load.
- White River CSO area -- **1.20×10^{12} cfu**, which requires a 99.7% required reduction in the average daily bacteria load.

- White River South --**1.49x 10^{12} cfu**, which requires a 99.7% reduction in the average daily bacteria load.

A representative load reduction scenario was evaluated using the daily *E. coli* bacteria model. This scenario is representative of the current and future watershed programs being pursued by the City of Indianapolis. This program consists of removing illicit sanitary connections, converting failing septic systems to sanitary sewers in the Barrett Law Program, reducing stormwater loadings per the NPDES Permit Program, and controlling CSOs per the Final CSO LTCP[1]. The city's current stormwater NPDES Permit program is assumed to reduce the stormwater *E. coli* bacteria load by approximately 10 percent. This reduction is considered to be an estimate of the program's effectiveness, not an objective.

Although it is not an element of the city's programs, all scenarios have assumed that White River at the Hamilton County boundary will not exceed the 125 cfu/ 100 ml monthly geometric mean standard. A TMDL is currently underway for the White River in Hamilton County that will address the upstream sources of *E. coli* bacteria.

6.4 Findings of Simulated Scenarios

Table 6.4 contains a summary of the performance of the control scenarios compared with TMDL targets of 125 cfu/100 ml for monthly geometric mean, percent of days with *E. coli* bacteria above 235 cfu/100 ml, and number of days per year with *E. coli* bacteria above 10,000 cfu/100 ml. The findings show that all three criteria can be met under dry weather flow conditions upstream and within the CSO area by the removal of failing septic systems and illicit sanitary connections. The findings also show that significant reductions in wet weather *E. coli* bacteria can be achieved by stormwater and CSO controls. **Figures 6.3 through 6.5** contain plots of the TMDL criteria for all White River scenarios.

Additional controls beyond the scenarios presented may be necessary to achieve the TMDL. Table 6.4 also contains the additional load reduction required to meet the TMDL

6.5 Margin of Safety

The Margin of Safety (MOS) is a required component of TMDL development. There are two basic methods for incorporating the MOS: 1) Implicitly incorporate the MOS using conservative model assumptions to develop allocations; or 2) Explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. For this TMDL the MOS was implicitly incorporated into the modeling process by selecting a critical time period and critical default values for each of the summer and winter seasons based on the results of a 10-year simulation.

[1] The modeled load reduction was the recommended plan in the April 2001 Draft LTCP. The recommended level of CSO control was 85% capture, or 12 overflow events per year. The final CSO LTCP is in development.

Figure 6.1: Predicted White River CSO Area Daily *E. coli* Bacteria Counts

April 1, 1997 through October 31, 1997

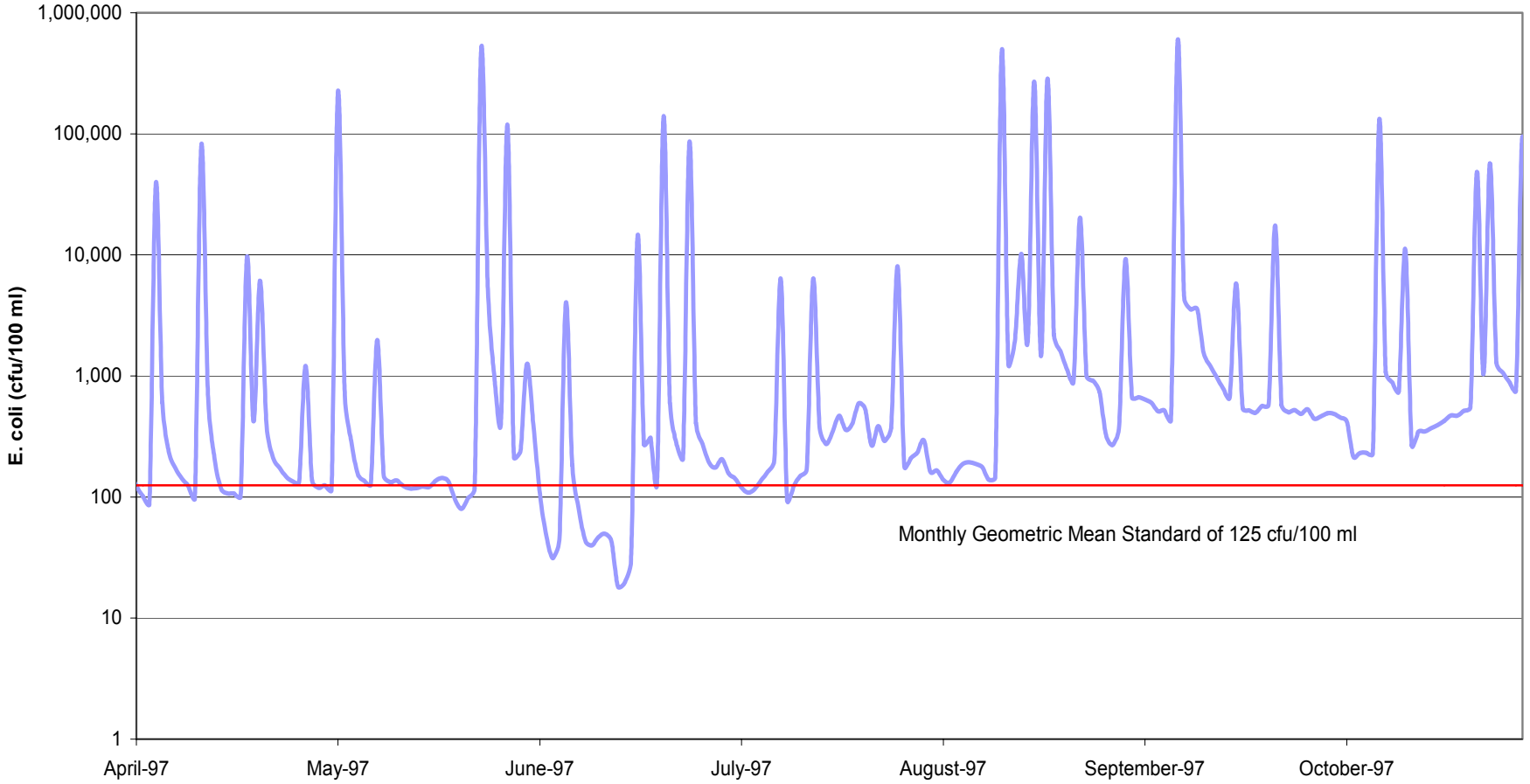


Figure 6.2: Predicted White River South Daily *E. coli* Bacteria Counts

April 1, 1997 through October 31, 1997

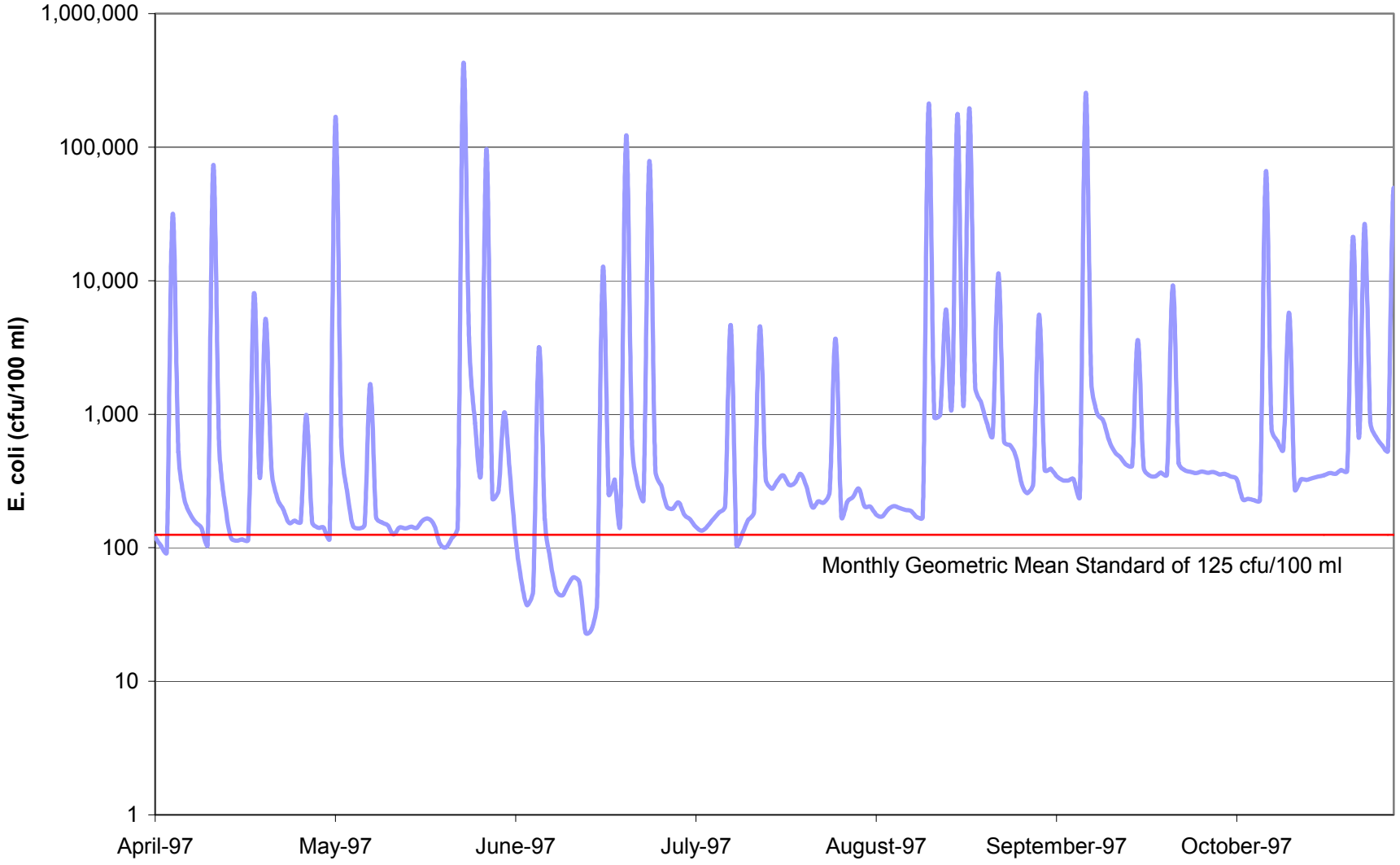
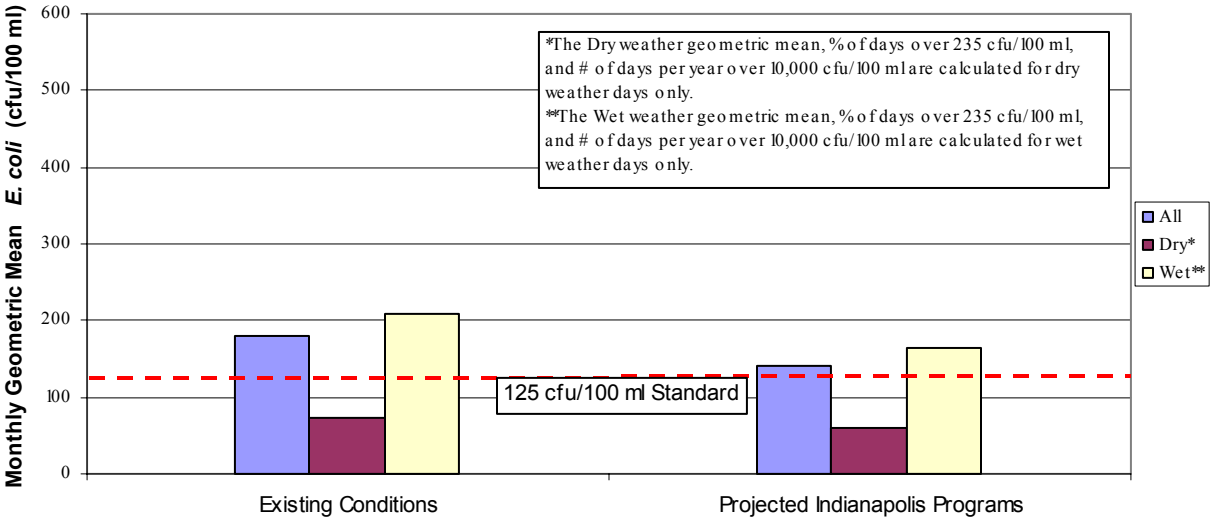
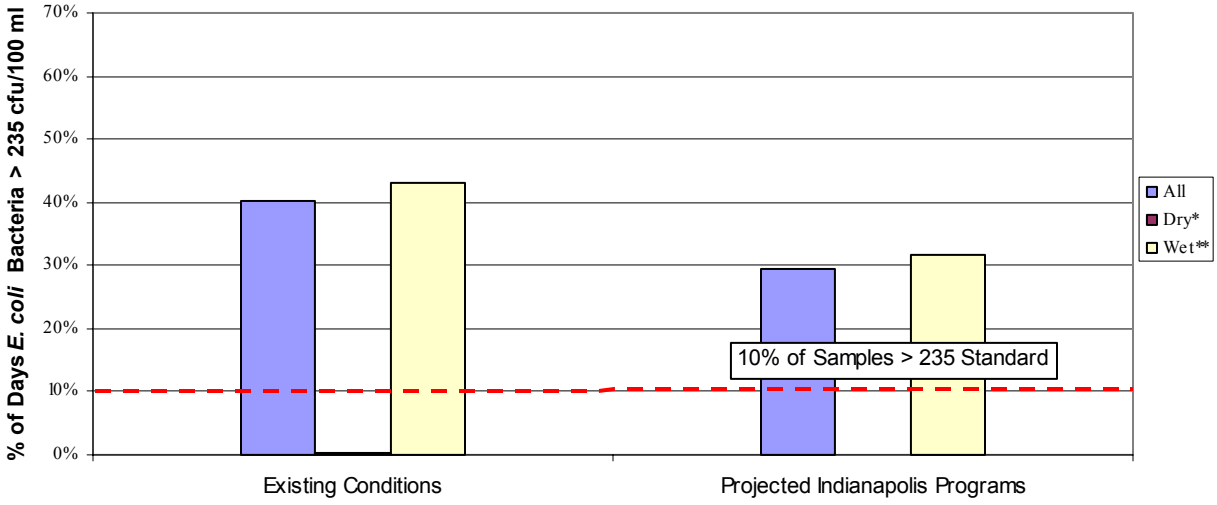


Figure 6.3: White River North -- *E. coli* Bacteria Geometric Mean
% of Days E. coli Bacteria > 235 cfu/100 ml
# of Days per year E. coli Bacteria > 10,000 cfu/100 ml





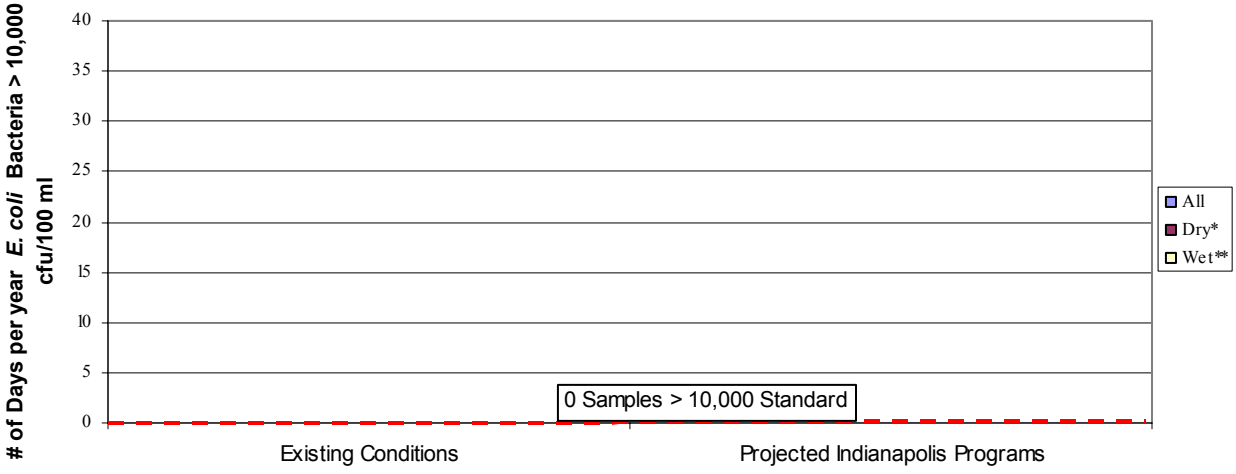
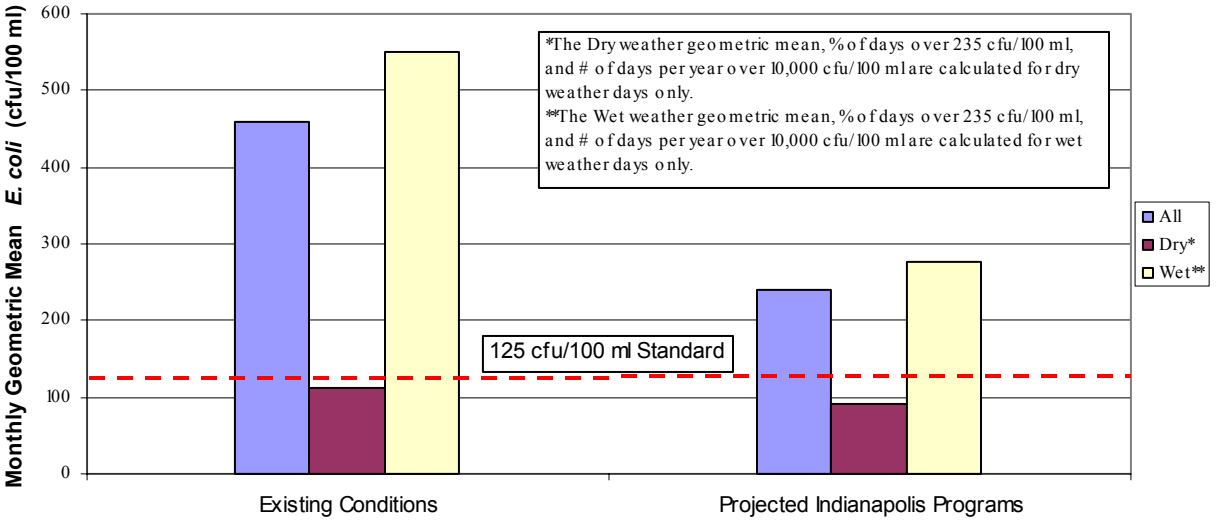
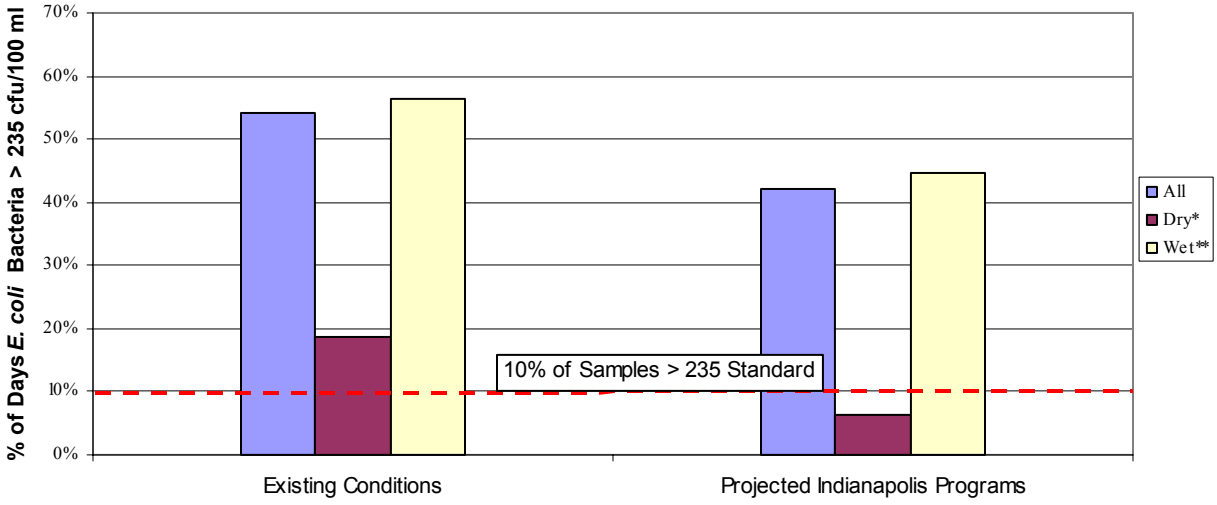


Figure 6.4: White River CSO Area -- *E. coli* Bacteria Geometric Mean
% of Days E. coli Bacteria > 235 cfu/100 ml
# of Days per year E. coli Bacteria > 10,000 cfu/100 ml





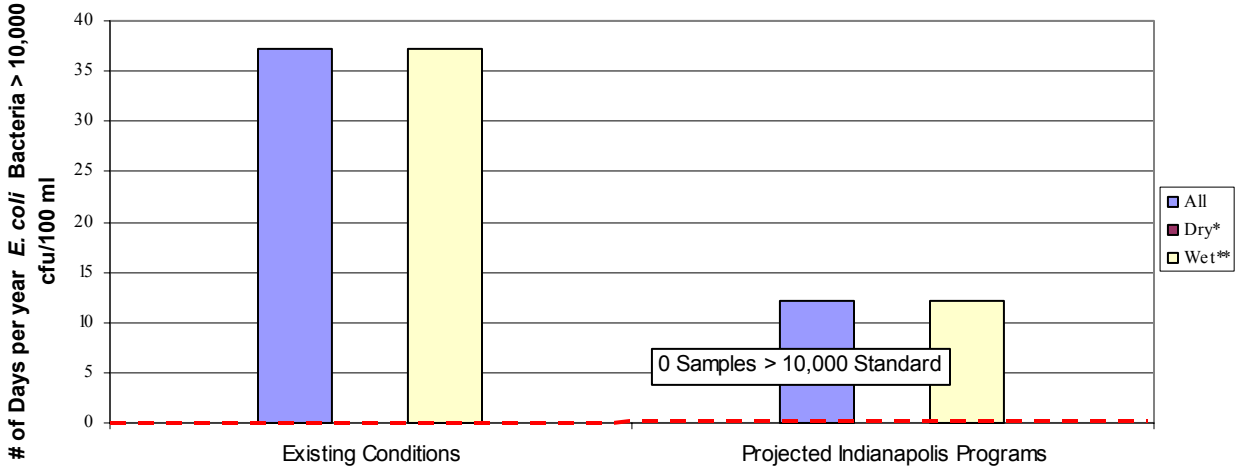
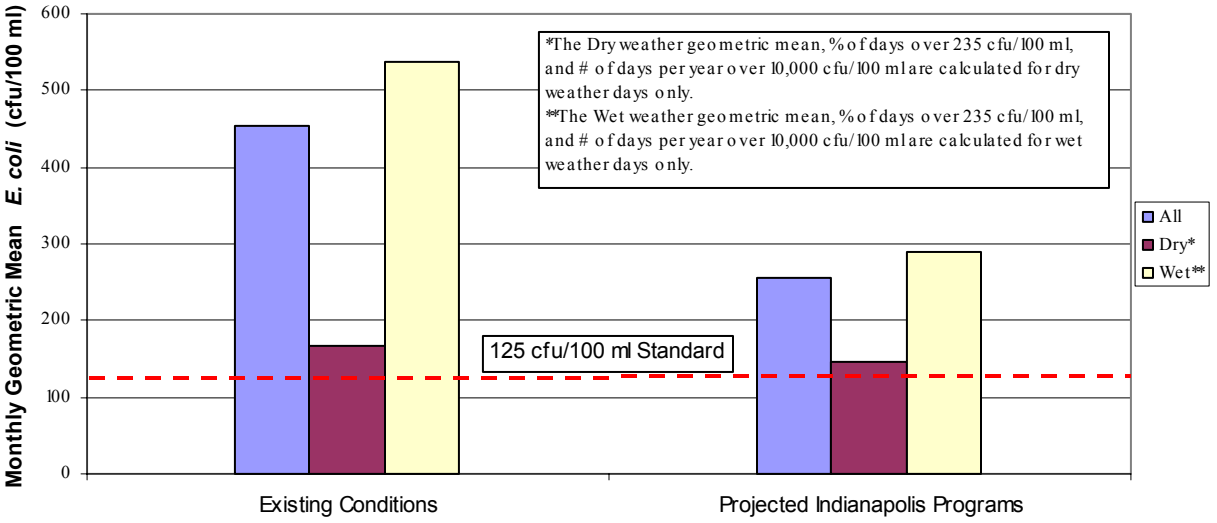
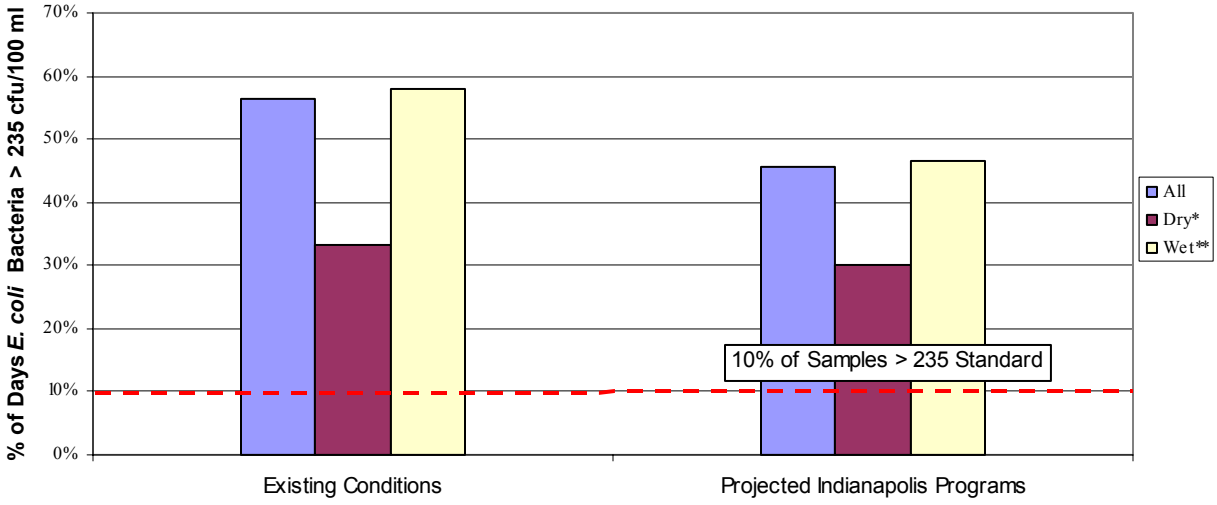


Figure 6.5: White River South -- *E. coli* Bacteria Geometric Mean
% of Days E. coli Bacteria > 235 cfu/100 ml
# of Days per year E. coli Bacteria > 10,000 cfu/100 ml





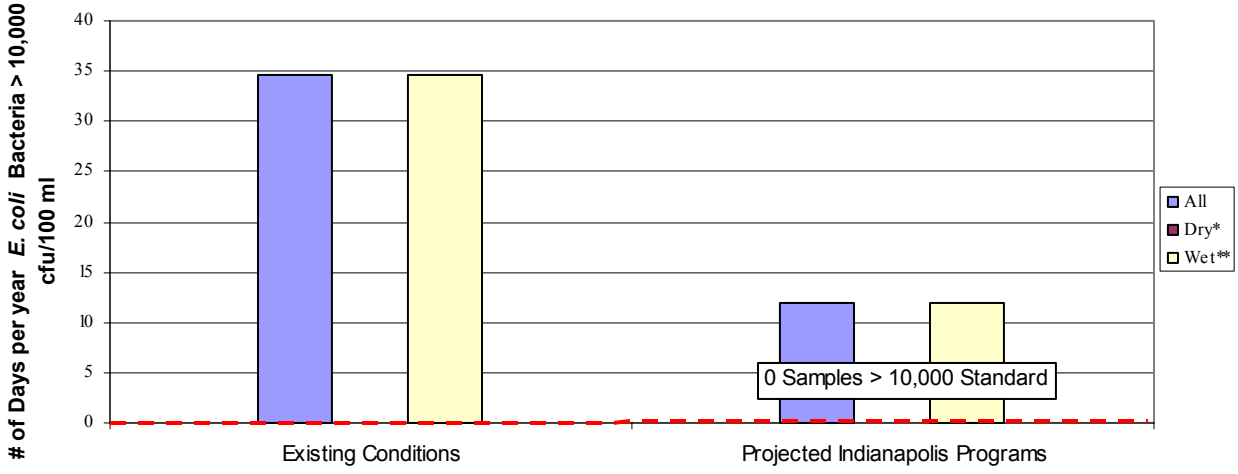


TABLE 6.1: SAMPLE OF WHITE RIVER CSO AREA DAILY *E. coli* COUNTS

Date	Average Daily Flow (cfs)	CSO Flow (cfs)	Total Flow (cfs)	Hamilton Co. Load (cfu/day)	Septic Load (cfu/day)	Illicit Load (cfu/day)	AWT Load (cfu/day)	Wildlife Load (cfu/day)	Stormwater Runoff Load (cfu/day)	CSO Load (cfu/day)	Total Load (cfu/day)	Resulting Concentration (cfu/100 ml)
10/1/1991	83	0	83	3.36E+11	1.34E+11	2.84E+08	1.26E+11	1.15E+11	0.00E+00	0.00E+00	7.11E+11	350
10/2/1991	67	0	67	3.36E+11	1.34E+11	2.84E+08	1.26E+11	1.15E+11	0.00E+00	0.00E+00	7.11E+11	434
10/3/1991	143	8	151	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	5.07E+12	1.98E+14	2.04E+14	55,505
10/4/1991	116	0	116	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.25E+12	0.00E+00	2.66E+12	939
10/5/1991	319	101	420	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.71E+13	2.59E+15	2.62E+15	254,814
10/6/1991	221	0	221	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	8.41E+12	0.00E+00	9.83E+12	1,818
10/7/1991	178	0	178	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.94E+12	0.00E+00	6.36E+12	1,460
10/8/1991	150	0	150	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.18E+12	0.00E+00	4.59E+12	1,251
10/9/1991	129	0	129	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.14E+12	0.00E+00	3.55E+12	1,126
10/10/1991	173	3	176	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.34E+12	6.59E+13	7.17E+13	16,689
10/11/1991	156	0	156	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.08E+12	0.00E+00	3.50E+12	918
10/12/1991	117	0	117	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.38E+12	0.00E+00	2.80E+12	979
10/13/1991	106	0	106	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	9.72E+11	0.00E+00	2.39E+12	921
10/14/1991	120	1	121	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.11E+12	3.62E+13	3.97E+13	13,367
10/15/1991	125	0	125	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.21E+12	0.00E+00	2.63E+12	859
10/16/1991	110	0	110	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	7.67E+11	0.00E+00	2.18E+12	812
10/17/1991	110	0	110	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	5.33E+11	0.00E+00	1.95E+12	725
10/18/1991	116	0	116	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.82E+11	0.00E+00	1.80E+12	634
10/19/1991	113	0	113	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	6.68E+11	0.00E+00	2.08E+12	754
10/20/1991	117	0	117	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.33E+11	0.00E+00	1.75E+12	611
10/21/1991	127	0	127	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.20E+11	0.00E+00	1.64E+12	527
10/22/1991	128	0	128	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.52E+11	0.00E+00	1.57E+12	501
10/23/1991	127	0	127	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.08E+11	0.00E+00	1.52E+12	491
10/24/1991	136	1035	1171	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.16E+11	2.67E+16	2.67E+16	930,498
10/25/1991	265	0	265	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.79E+13	0.00E+00	3.94E+13	6,071
10/26/1991	2540	0	2540	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.04E+14	0.00E+00	2.06E+14	3,308
10/27/1991	1710	0	1710	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	9.62E+13	0.00E+00	9.76E+13	2,334
10/28/1991	994	0	994	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.22E+13	0.00E+00	3.36E+13	1,383
10/29/1991	654	0	654	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.50E+13	0.00E+00	1.64E+13	1,027
10/30/1991	393	7	400	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	8.17E+12	1.82E+14	1.92E+14	19,614
10/31/1991	294	0	294	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.91E+12	0.00E+00	6.33E+12	880
11/1/1991	332	0	332	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	6.58E+12	0.00E+00	8.00E+12	985
11/2/1991	306	0	306	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.13E+12	0.00E+00	5.54E+12	740
11/3/1991	251	0	251	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.57E+12	0.00E+00	3.99E+12	649
11/4/1991	228	0	228	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.86E+12	0.00E+00	3.28E+12	588
11/5/1991	223	0	223	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.29E+12	0.00E+00	2.71E+12	496
11/6/1991	211	0	211	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	9.17E+11	0.00E+00	2.33E+12	452
11/7/1991	197	0	197	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	1.13E+12	7.77E+12	1.03E+13	2,138
11/8/1991	208	0	208	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	6.99E+11	0.00E+00	2.12E+12	416
11/9/1991	204	0	204	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.86E+11	0.00E+00	1.90E+12	381
11/10/1991	199	0	199	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	3.53E+11	0.00E+00	1.77E+12	364
11/11/1991	197	0	197	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.61E+11	0.00E+00	1.68E+12	348
11/12/1991	203	1	204	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	9.62E+11	2.22E+13	2.46E+13	4,933
11/13/1991	196	0	196	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	4.72E+11	0.00E+00	1.89E+12	394
11/14/1991	190	1	191	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	2.78E+11	1.39E+13	1.56E+13	3,345
11/15/1991	200	0	200	1.04E+12	1.34E+11	2.84E+08	1.26E+11	1.15E+11	5.70E+11	0.00E+00	1.99E+12	406

TABLE 6.2: COMPARISON OF OBSERVED AND MODELED E. COLI COUNTS
WHITE RIVER

	Geometric Mean			% of Days > 235			# of Samples >10000 Per Year		
Stream Reach	All	Dry**	Wet***	All	Dry**	Wet***	All	Dry**	Wet***
White River-North Measured*	166	74	236	33%	19%	39%	1	0	1
White River-North Modeled	181	73	210	40%	0%	43%	0	0	0
White River-CSO Measured*	238	99	561	46%	25%	67%	3	0	3
White River-CSO Modeled	459	113	551	54%	19%	56%	37	0	37
White River-South Measured*	410	165	1159	64%	44%	86%	1	0	1
White River-South Modeled	455	166	539	56%	33%	58%	35	0	35

*Measured *E. Coli* Counts are reported in Table 4.2

**The Dry weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for dry weather days only

***The Wet weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for wet weather days only

TABLE 6.3: TOTAL AVERAGE E. COLI DAILY LOAD
WHITE RIVER

Watershed	Average Daily Septic Load (cfu)	Average Daily Illicit Connection Load (cfu)	Average Daily Wildlife Load (cfu)	Average Daily AWT Load (cfu)	Average Daily Stormwater Load (cfu)	Average Daily CSO Load (cfu)	Total Average Daily Load (cfu)	Total Cumulative Daily Load (cfu)
Inflow from Hamilton County			3.36E+11		7.06E+11		1.04E+12	
Howland & Johnson Ditch	1.64E+10	0.00E+00	9.79E+08				1.74E+10	
Crooked & Williams Creek	4.17E+10	1.06E+08	1.19E+10				5.36E+10	
White River North	3.91E+10	1.51E+07	7.31E+10		4.54E+12		4.65E+12	**5.76E+12**
Fall Creek -- Reduced 75% for Dry Weather	1.16E+10	4.35E+07	1.92E+10		1.76E+12	1.10E+14	1.12E+14	
Pleasant Run -- Reduced 75% for Dry Weather	2.39E+09	2.84E+07	4.89E+08		2.99E+11	4.13E+13	4.16E+13	
Pogues Run CSO						1.28E+14	1.28E+14	
Eagle Creek CSO						5.62E+12	5.62E+12	
White River CSO	2.26E+10	9.08E+07	9.49E+09	1.26E+11	1.90E+12	1.43E+14	1.45E+14	**4.38E+14**
White River South	4.73E+10	1.51E+07	6.41E+11	1.60E+11	1.24E+12		2.08E+12	**4.40E+14**

*Note: Flows for Howland Ditch, and Johnson Ditch are not currently known. The bacteria loading was assumed to be the same as Pleasant Run

**Note: Stormwater loads for Howland Ditch, Crooked Creek, Johnson Ditch, and Williams Creek are lumped into the White River loads

***Note: Septic Loads from Eagle and Guion Creeks are lumped into the White River CSO Loads

****Note: Septic Loads from State Ditch, Lick Creek, and Buck Creek are lumped into the White River South Loads

TABLE 6.4: EFFECTS OF WATERSHED IMPROVEMENT SCENARIOS
WHITE RIVER

	Geometric Mean of *E. coli* bacteria			% of Days *E. coli* bacteria > 235 cfu/100 ml			# of Days per year *E. coli* bacteria > 10,000 cfu/100 ml			Additional Load Reduction Required to meet the allowable TMDL (cfu)***
Scenario	All	Dry*	Wet**	All	Dry*	Wet**	All	Dry*	Wet**	
TMDL Objectives	**125**			**10%**			**0**			
White River-North Existing	181	**73**	210	40%	**0%**	43%	**0**	**0**	**0**	4.72E+12
White River-North Projected Indianapolis Programs	142	**60**	163	29%	**0%**	32%	**0**	**0**	**0**	3.84E+12
White River-CSO Existing	459	**113**	551	54%	19%	56%	37	**0**	37	4.37E+14
White River-CSO Projected Indianapolis Programs	239	**91**	276	42%	**6%**	45%	12	**0**	12	1.42E+14
White River-South Existing	455	166	539	56%	33%	58%	35	**0**	35	4.39E+14
White River-South Projected Indianapolis Programs	255	147	290	45%	30%	47%	12	**0**	12	1.44E+14

Note: *E. coli* counts below the TMDL Objective are in bold

*The Dry weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for dry weather days only

**The Wet weather geometric mean, % of days over 235 cfu/100 ml, and # of days per year over 10,000 cfu/100 ml are calculated for wet weather days only

***The TMDL for the White River North reach is 1.04x10^12 cfu
The TMDL for the White River CSO area is 1.20x10^12 cfu
The TMDL for the White River South reach is 1.49x10^12 cfu

Section 7
Public Participation

To date, the IDEM has held three public stakeholder meetings to present the progress of the TMDL program for the White River. Information such as a summary of findings, characterization of the river, weather conditions and how results are affected, model introduction, and an overview of the TMDL process were presented. The public participation meetings were held on September 17, 2002; December 16, 2002; and March 31, 2003. Future meetings are planned in order to present the findings of this report to community stakeholders.

IDEM invited all registered neighborhood organizations in Indianapolis, as well as all major environmental groups. Environmental groups in attendance at the public stakeholder meetings include the Wet Weather Technical Advisory Committee and the Friends of the White River.

In addition to the TMDL process, water quality-related public outreach is a key component of the city's CSO LTCP and stormwater programs.

Section 8
Implementation Activities and Schedule

There are no specific activities planned as a result of this TMDL study, but this TMDL study has been incorporated into the existing programs for control of stormwater, septic systems, and CSOs. The TMDL process is incorporated into all of these programs, which are briefly described below.

8.1 Stormwater Program

The city utilizes new construction or redevelopment permitting as an opportunity to control stormwater flows that discharge into receiving streams or the CSO system through the recently revised Chapter 700 to Section 581 of the City of Indianapolis Code (Stormwater Management and Sediment Control). Chapter 700 requires best management practices (BMPs) to improve the quality of the stormwater runoff whenever new construction or redevelopment that disturbs more than 1/2 - acre is proposed anywhere in Marion County. The city is implementing this proactive approach in the CSO area to improve water quality even though it is not required by the NPDES stormwater permit. The city requires that prior to new construction, reconstruction, or remodeling, contractors and developers must submit a stormwater control plan and obtain drainage permits to address stormwater runoff originating from the sites. In the CSO area, controlling stormwater runoff has the added benefit of potentially reducing CSO discharges to the receiving streams. In addition, at locations where the stormwater runoff is controlled and then treated by BMPs before being discharged directly to the receiving streams, the city stormwater programs require developers to improve the urban stormwater quality.

Control of stormwater runoff quality is based on the management of total suspended solids (TSS). The target TSS removal rate is 80%. The requirements apply to all areas of the county except the city limits of Beech Grove, Lawrence, Southport and Speedway. Control of sediment is required for construction site runoff citywide.

Based on the target TSS removal rate and application of the target rate, the city's current stormwater NPDES Permit program is assumed to reduce the stormwater *E. coli* bacteria load by 10 percent. This reduction is considered to be an estimate of the program's effectiveness, not an objective.

8.2 Barrett Law Septic Program

Of the 320,000 homes in Marion County, approximately 18,000 are served by septic systems that were targeted for replacement in the 1998 Barrett Law Master Plan. The Barrett Law Master Plan prioritized 161 unsewered areas for conversion to sewers. The master plan ranks each area based on the following criteria: septic failure rate, stream bacteriological impairment, wellfield protection, presence of residential wells, proximity to greenways, petitions from residents or Marion County Health & Hospital Corp., number of residents in favor of the project, cost, and downstream capacity. These areas are then placed into one of four categories: Priority 1, Priority 2, Priority 3, and all others.

8.3 CSO Long Term Control Plan

In 2001, the City of Indianapolis submitted a CSO Long Term Control Plan (LTCP) for review to IDEM and the USEPA. This plan proposed an 85% level of capture to achieve water quality standards within the streams of Indianapolis given financial constraints. The plan consisted of AWT enhancements, various system control alternatives, streambank restoration and sediment removal, and accelerated septic system removal.

Negotiations with IDEM and Region V EPA are ongoing and may affect the final level of capture and pollutant removal rates achieved through the LTCP. A final CSO LTCP is expected in spring 2004.

Section 9
Monitoring Plan

An integral part of managing the progress of a TMDL program is monitoring. The current monitoring programs performed by the City of Indianapolis Office of Environmental Services and the Marion County Health Department will continue throughout the implementation of load allocations. These monitoring programs consist of sampling at the locations described in Section 3 of this report at the intervals described in that same section. Continuous dissolved oxygen monitors will be maintained at the three locations listed previously.

As the city's watershed improvement programs are implemented, this continued monitoring will allow the city and IDEM the opportunity to review progress towards meeting water quality standards.

In accordance with EPA's guidance, IDEM and the city reserve the right to revise the projected programs if necessary.

References

AMEC. 2003. *City of Indianapolis Fifth Annual Report (2002)*

Camp Dresser & McKee (CDM). 2003. *CSO Control Technologies Evaluation.*

Camp Dresser & McKee (CDM). 2003. *Fall Creek TMDL Report.*

U.S. Environmental Protection Agency (EPA). 2001. *Protocol for Developing Pathogen TMDLs*

WHITE RIVER TMDL REPORT

APPENDICES

Date	Sampling Location							
	82nd Street							
	NH3-T (mg/L)	Temp (C)	pH (units)	1992 Standard (mg/L)		1999 Standard Total Ammonia	% Compliance with Indiana Standard	% Compliance 1999 Standard
				Standard - Unionized Ammonia	Standard - Total Ammonia			
1/5/2000	0.81	3.51	8.15	0.0692	4.50	1.0131	1	1
2/2/2000	0.23	1.03	8.06	0.0583	5.69	1.1630	1	1
3/1/2000	0.10	10.04	8.09	0.1075	4.78	1.1115	1	1
4/5/2000	0.10	10.71	8.62	0.1134	1.49	0.4642	1	1
5/3/2000	0.10	18.16	8.33	0.1907	2.76	0.7569	1	1
6/7/2000	0.52	18.89	8.35	0.1998	2.64	0.7321	1	1
7/5/2000	0.10	25.52	7.81	0.1923	5.24	1.6407	1	1
8/9/2000	0.22	23.79	7.67	0.1737	7.29	1.9303	1	1
9/6/2000	0.20	21.06	8.08	0.2137	4.36	1.1285	1	1
10/4/2000	0.22	20.44	8.21	0.2137	3.43	0.9211	1	1
11/1/2000	0.10	14.12	8.13	0.1435	4.30	1.0453	1	1
12/6/2000	0.21	0.51	8.67	0.0560	1.44	0.4270	1	1
1/15/2001	0.10	2.71	8.07	0.0657	5.46	1.1457	1	1
2/12/2001	0.27	2.55	7.86	0.0607	8.25	1.5397	1	1
3/6/2001	0.22	4.51	8.09	0.0736	5.06	1.1115	1	1
4/4/2001	0.18	10.45	8.27	0.1111	3.20	0.8357	1	1
5/2/2001	0.42	20.62	8.15	0.2137	3.85	1.0131	1	1
6/13/2001	0.19	25.18	7.71	0.1793	6.25	1.8471	1	1
7/11/2001	0.29	24.9	7.73	0.1819	6.18	1.8056	1	1
8/8/2001	0.24	28.57	7.99	0.2125	3.19	1.2887	1	1
9/5/2001	0.17	23.32	8.17	0.2137	3.07	0.9818	1	1
10/3/2001	0.14	17.44	7.88	0.1823	7.49	1.4998	1	1
11/7/2001	0.11	9.61	7.94	0.1015	6.55	1.3828	1	1
12/4/2001	0.16	9.29	8.22	0.1027	3.61	0.9064	1	1

Date	Sampling Location							
	Morris Street							
				1992 Standard (mg/L)		1999	%	%
	NH3-T (mg/L)	Temp (C)	pH (units)	Standard - Unionized Ammonia	Standard - Total Ammonia	Standard Total Ammonia	Compliance with Indiana Standard	Compliance 1999 Standard
1/5/2000	1.06	3.57	8.13	0.0695	4.70	1.0453	1	0
2/2/2000	0.10	1.26	7.95	0.0577	7.11	1.3638	1	1
3/1/2000	0.10	10.61	8.25	0.1125	3.35	0.8635	1	1
4/5/2000	0.10	11.09	8.68	0.1167	1.32	0.4199	1	1
5/3/2000	0.10	18.11	8.40	0.1937	2.43	0.6733	1	1
6/7/2000	0.10	20.60	8.55	0.2137	1.66	0.5224	1	1
7/5/2000	0.10	26.13	8.08	0.2137	3.10	1.1285	1	1
8/9/2000	0.21	25.02	7.65	0.1709	6.88	1.9719	1	1
9/6/2000	0.27	22.21	8.09	0.2137	3.94	1.1115	1	1
10/4/2000	0.10	19.94	8.20	0.2130	3.61	0.9360	1	1
11/1/2000	0.10	14.76	8.13	0.1492	4.26	1.0453	1	1
12/6/2000	0.10	1.31	8.60	0.0595	1.68	0.4801	1	1
1/15/2001	0.10	0.94	8.06	0.0578	5.69	1.1630	1	1
2/12/2001	0.22	3.01	7.67	0.0544	11.01	1.9303	1	1
3/6/2001	0.30	4.26	7.94	0.0703	6.93	1.3828	1	1
4/4/2001	0.10	11.50	8.47	0.1204	2.07	0.5982	1	1
5/2/2001	0.18	20.49	7.88	0.2006	6.62	1.4998	1	1
6/13/2001	0.22	24.85	7.68	0.1752	6.67	1.9095	1	1
7/11/2001	0.20	25.80	8.00	0.2135	3.76	1.2703	1	1
8/8/2001	0.16	30.00	8.53	0.2137	1.00	0.5404	1	1
9/5/2001	0.10	24.51	7.77	0.1872	5.97	1.7228	1	1
10/3/2001	0.15	17.78	8.47	0.1860	2.05	0.5982	1	1
11/7/2001	0.20	10.65	8.38	0.1128	2.51	0.6963	1	1
12/4/2001	0.16	9.25	8.47	0.1024	2.08	0.5982	1	1

Date	Sampling Location							
	Harding Street							
	NH3-T (mg/L)	Temp (C)	pH (units)	1992 Standard (mg/L)		1999 Standard Total Ammonia	% Compliance with Indiana Standard	% Compliance 1999 Standard
				Standard - Unionized Ammonia	Standard - Total Ammonia			
1/5/2000	0.96	4.11	7.99	0.0715	6.36	1.2887	1	1
2/2/2000	0.19	1.49	7.87	0.0563	8.16	1.5197	1	1
3/1/2000	0.10	10.72	8.15	0.1135	4.19	1.0131	1	1
4/5/2000	0.10	11.42	8.62	0.1197	1.50	0.4642	1	1
5/3/2000	0.29	18.24	8.63	0.1917	1.48	0.4565	1	1
6/7/2000	0.10	20.16	8.50	0.2137	1.90	0.5686	1	1
7/5/2000	0.10	25.87	7.92	0.2051	4.28	1.4214	1	1
8/9/2000	0.24	25.04	7.71	0.1793	6.31	1.8471	1	1
9/6/2000	0.35	22.22	7.82	0.1935	6.47	1.6204	1	1
10/4/2000	0.10	19.97	7.78	0.1881	8.07	1.7022	1	1
11/1/2000	0.10	15.35	8.01	0.1556	5.56	1.2521	1	1
12/6/2000	0.10	1.39	8.55	0.0598	1.88	0.5224	1	1
1/15/2001	0.10	1.61	7.85	0.0561	8.43	1.5597	1	1
2/12/2001	0.21	3.12	7.71	0.0566	10.35	1.8471	1	1
3/6/2001	0.21	4.27	7.90	0.0689	7.43	1.4604	1	1
4/4/2001	0.10	10.83	7.88	0.1074	7.23	1.4998	1	1
5/2/2001	0.18	20.53	7.71	0.1793	8.65	1.8471	1	1
6/13/2001	0.18	24.39	7.50	0.1489	8.79	2.2780	1	1
7/11/2001	0.18	26.18	8.15	0.2137	2.66	1.0131	1	1
8/8/2001	0.21	29.41	8.38	0.2137	1.37	0.6963	1	1
9/5/2001	0.19	24.52	8.08	0.2137	3.44	1.1285	1	1
10/3/2001	0.15	18.12	7.97	0.1873	5.99	1.3260	1	1
11/7/2001	0.13	10.55	7.98	0.1108	6.07	1.3073	1	1
12/4/2001	0.15	8.27	8.27	0.0963	3.28	0.8357	1	1

Date	Sampling Location							
	Tibbs/Banta							
	NH3-T (mg/L)	Temp (C)	pH (units)	1992 Standard (mg/L)		1999 Standard Total Ammonia	% Compliance with Indiana Standard	% Compliance 1999 Standard
				Standard - Unionized Ammonia	Standard - Total Ammonia			
1/5/2000	0.60	9.11	7.49	0.0700	13.11	2.2978	1	1
2/2/2000	0.38	10.96	7.39	0.0714	14.55	2.4897	1	1
3/1/2000	0.10	12.58	7.75	0.1122	8.87	1.7641	1	1
4/5/2000	0.22	15.69	7.54	0.1159	11.70	2.1979	1	1
5/3/2000	0.49	20.08	7.79	0.1898	7.89	1.6817	1	1
6/7/2000	0.10	20.57	7.75	0.1846	8.11	1.7641	1	1
7/5/2000	0.24	24.85	7.71	0.1793	6.39	1.8471	1	1
8/9/2000	0.80	24.98	7.67	0.1737	6.71	1.9303	1	1
9/6/2000	0.77	22.21	7.85	0.2105	6.59	1.5597	1	1
10/4/2000	0.22	24.25	7.73	0.1819	6.46	1.8056	1	1
11/1/2000	0.54	20.89	7.60	0.1638	9.87	2.0754	1	1
12/6/2000	0.29	7.60	7.89	0.0869	7.35	1.4801	1	1
1/15/2001	0.32	5.75	7.19	0.0384	18.71	2.8286	1	1
2/12/2001	0.23	3.32	7.98	0.0642	6.23	1.3073	1	1
3/6/2001	0.18	6.83	7.51	0.0614	13.15	2.2581	1	1
4/4/2001	0.13	13.72	7.64	0.1110	10.35	1.9927	1	1
5/2/2001	0.27	22.50	7.26	0.1123	13.08	2.7177	1	1
6/13/2001	0.21	24.37	7.40	0.1336	9.91	2.4711	1	1
7/11/2001	0.17	26.09	7.86	0.1982	4.65	1.5397	1	1
8/8/2001	0.30	28.33	7.45	0.1413	7.12	2.3760	1	1
9/5/2001	0.23	24.69	7.56	0.1578	7.97	2.1573	1	1
10/3/2001	0.18	20.78	7.73	0.1819	8.24	1.8056	1	1
11/7/2001	0.21	12.39	7.97	0.1262	6.15	1.3260	1	1
12/4/2001	0.20	10.15	7.48	0.0740	13.07	2.3176	1	1

Date	Sampling Location							
	Southwestway Pk							
	NH3-T (mg/L)	Temp (C)	pH (units)	1992 Standard (mg/L)		1999 Standard Total Ammonia	% Compliance with Indiana Standard	% Compliance 1999 Standard
				Standard - Unionized Ammonia	Standard - Total Ammonia			
1/5/2000	0.53	9.79	7.54	0.0766	12.14	2.1979	1	1
2/2/2000	0.99	10.27	7.49	0.0755	12.91	2.2978	1	1
3/1/2000	0.27	12.48	7.76	0.1122	8.74	1.7434	1	1
4/5/2000	0.47	15.66	7.54	0.1156	11.70	2.1979	1	1
5/3/2000	0.46	19.77	7.74	0.1808	8.60	1.7848	1	1
6/7/2000	0.30	19.96	7.77	0.1867	8.19	1.7228	1	1
7/5/2000	0.35	24.88	7.66	0.1723	6.85	1.9511	1	1
8/9/2000	0.47	24.85	7.62	0.1666	7.27	2.0341	1	1
9/6/2000	0.76	22.15	7.78	0.1885	6.93	1.7022	1	1
10/4/2000	0.19	24.16	7.65	0.1709	7.31	1.9719	1	1
11/1/2000	0.31	20.52	7.61	0.1652	9.99	2.0547	1	1
12/6/2000	0.35	8.56	8.01	0.0918	5.49	1.2521	1	1
1/15/2001	0.29	6.87	7.11	0.0371	19.84	2.9446	1	1
2/12/2001	0.25	3.45	7.92	0.0662	7.29	1.4214	1	1
3/6/2001	0.22	6.85	7.45	0.0577	14.17	2.3760	1	1
4/4/2001	0.15	14.07	7.58	0.1077	11.21	2.1164	1	1
5/2/2001	0.25	22.46	7.10	0.0892	15.01	2.9583	1	1
6/13/2001	0.18	24.28	7.20	0.1034	12.17	2.8133	1	1
7/11/2001	0.26	25.91	7.82	0.1935	5.02	1.6204	1	1
8/8/2001	0.42	27.53	7.48	0.1458	7.25	2.3176	1	1
9/5/2001	0.26	24.46	7.58	0.1608	7.88	2.1164	1	1
10/3/2001	0.20	20.90	7.88	0.2114	6.78	1.4998	1	1
11/7/2001	0.15	12.32	8.22	0.1276	3.57	0.9064	1	1
12/4/2001	0.28	10.83	7.73	0.0974	9.22	1.8056	1	1

Date	Sampling Location							
	Waverly (SR 144)							
	NH3-T (mg/L)	Temp (C)	pH (units)	1992 Standard (mg/L)		1999 Standard Total Ammonia	% Compliance with Indiana Standard	% Compliance 1999 Standard
				Standard - Unionized Ammonia	Standard - Total Ammonia			
1/5/2000	0.55	8.17	7.85	0.0882	7.81	1.5597	1	1
2/2/2000	0.79	8.58	7.98	0.0972	6.20	1.3073	1	1
3/1/2000	0.71	12.87	7.75	0.1144	8.85	1.7641	1	1
4/5/2000	0.28	14.17	7.73	0.1225	9.00	1.8056	1	1
5/3/2000	0.38	19.61	7.73	0.1778	8.75	1.8056	1	1
6/7/2000	0.10	19.88	7.89	0.2004	6.76	1.4801	1	1
7/5/2000	0.10	25.86	7.82	0.1935	5.04	1.6204	1	1
8/9/2000	0.43	24.84	7.41	0.1351	9.48	2.4523	1	1
9/6/2000	0.28	21.84	7.87	0.1994	6.12	1.5197	1	1
10/4/2000	0.10	23.04	6.99	0.0654	13.58	3.0965	1	1
11/1/2000	0.26	18.83	7.83	0.1813	7.54	1.6001	1	1
12/6/2000	0.43	6.98	8.14	0.0882	4.44	1.0291	1	1
1/15/2001	0.27	6.35	7.39	0.0521	15.26	2.4897	1	1
2/12/2001	0.26	3.79	8.05	0.0705	5.61	1.1805	1	1
3/6/2001	0.18	6.80	7.46	0.0582	14.01	2.3567	1	1
4/4/2001	0.10	13.60	7.50	0.0968	12.53	2.2780	1	1
5/2/2001	0.21	21.87	6.80	0.0536	18.72	3.2859	1	1
6/13/2001	0.11	23.61	7.07	0.0853	14.16	2.9982	1	1
7/11/2001	0.20	25.54	7.69	0.1766	6.28	1.8887	1	1
8/8/2001	0.21	27.41	7.78	0.1885	4.83	1.7022	1	1
9/5/2001	0.13	24.19	7.66	0.1723	7.19	1.9511	1	1
10/3/2001	0.23	20.55	7.63	0.1681	9.70	2.0134	1	1
11/7/2001	0.15	12.76	8.30	0.1291	2.93	0.7955	1	1
12/4/2001	0.32	10.31	7.76	0.0955	8.79	1.7434	1	1

White River Cyani

Date	OES Sampling Sites					
	82nd Street		Morris Street		Harding Street	
	CN_T (ug/L)	% Compliance	CN_T (ug/L)	% Compliance	CN_T (ug/L)	% Compliance
3/1/2000	5.0	1	5.0	1	5.0	1
6/7/2000	5.0	1	5.0	1	5.0	1
9/6/2000	5.0	1	5.0	1	5.0	1
11/1/2000	5.0	1	5.0	1	5.0	1
3/6/2001	5	1	5	1	5	1
6/13/2001	5.0	1	5.0	1	5.0	1
9/5/2001	5.0	1	5.0	1	5.0	1
11/7/2001	5.0	1	5.0	1	5.0	1

ide Sampling Data

Date	OES Sampling Sites					
	Tibbs/Banta		Southwestway Pk		Waverly (SR 144)	
	CN_T (ug/L)	% Compliance	CN_T (ug/L)	% Compliance	CN_T (ug/L)	% Compliance
3/1/2000	6.0	0	11.0	0	23.0	0
6/7/2000	5.0	1	8.2	0	7.6	0
9/6/2000	6.8	0	7.5	0	8.4	0
11/1/2000	6.4	0	11.0	0	8.6	0
3/6/2001	5	1	5.8	0	9	0
6/13/2001	5.0	1	5.0	1	5.0	1
9/5/2001	5.0	1	5.0	1	5.0	1
11/7/2001	5.0	1	5.0	1	5.0	1

Date	OES Sampling Locations					
	82nd Street DO (mg/L)	% Compliance	Morris Street DO (mg/L)	% Compliance	Harding Street DO (mg/L)	% Compliance
1/5/2000	12.10	1	12.73	1	11.83	1
2/2/2000	15.72	1	15.92	1	15.82	1
3/1/2000	10.8	1	10.98	1	10.55	1
4/5/2000	11.96	1	11.3	1	12.42	1
5/3/2000	8.53	1	9.98	1	8.00	1
6/7/2000	8.76	1	10.49	1	9.78	1
7/5/2000	8.34	1	10.93	1	10.41	1
8/9/2000	6.34	1	7.66	1	7.32	1
9/6/2000	8.25	1	8.19	1	6.59	1
10/4/2000	7.81	1	9.14	1	9.88	1
11/1/2000	10	1	10.24	1	9.89	1
12/6/2000	14.89	1	13.97	1	14.10	1
1/15/2001	14.79	1	15.84	1	15.80	1
2/12/2001	12.73	1	13.35	1	13.05	1
3/6/2001	12.35	1	12.76	1	12.59	1
4/4/2001	11.7	1	11.65	1	11.78	1
5/2/2001	11.01	1	9.88	1	9.25	1
6/13/2001	9.49	1	9.84	1	8.32	1
7/11/2001	6.34	1	8.08	1	7.58	1
8/8/2001	6.69	1	9.62	1	11.48	1
9/5/2001	7.56	1	8.25	1	8.25	1
10/3/2001	8.76	1	9.35	1	9.19	1
11/7/2001	11.48	1	12.58	1	12.46	1
12/4/2001	10.64	1	11.5	1	11.45	1

Date	OES Sampling Locations					
	Tibbs/Banta DO (mg/L)	% Compliance	Southwestway Pk DO (mg/L)	% Compliance	Waverly (SR 144) DO (mg/L)	% Compliance
1/5/2000	10.41	1	9.63	1	9.88	1
2/2/2000	10.31	1	10	1	11.38	1
3/1/2000	10.12	1	9.79	1	9.14	1
4/5/2000	10.39	1	9.24	1	9.66	1
5/3/2000	8.09	1	8.28	1	7.72	1
6/7/2000	8.85	1	8.57	1	8.26	1
7/5/2000	10.03	1	8.81	1	8.31	1
8/9/2000	7.71	1	7.41	1	6.90	1
9/6/2000	6.85	1	6.46	1	6.10	1
10/4/2000	7.07	1	6.65	1	7.59	1
11/1/2000	7.5	1	7.02	1	7.6	1
12/6/2000	11.57	1	11.25	1	10.39	1
1/15/2001	13.60	1	12.74	1	12.26	1
2/12/2001	12.47	1	14.52	1	13.84	1
3/6/2001	11.83	1	11.59	1	11.19	1
4/4/2001	10.78	1	9.85	1	9.52	1
5/2/2001	7.42	1	6.95	1	6.88	1
6/13/2001	8.24	1	8.49	1	7.19	1
7/11/2001	7.30	1	7.07	1	6.85	1
8/8/2001	8.16	1	6.35	1	6.73	1
9/5/2001	7.07	1	6.64	1	7.26	1
10/3/2001	7.89	1	7.72	1	7.56	1
11/7/2001	12.3	1	10.78	1	10.23	1
12/4/2001	11.18	1	10.98	1	10.71	1

Date	MCHD Sampling Locations					
	Raymond Street DO mg/L	% Compliance	96th Street DO mg/L	% Compliance	Marina Drive DO mg/L	% Compliance
4/24/2000	9.39	1	8.79	1	12.81	1
5/22/2000	9.25	1	8.73	1	9.88	1
6/26/2000	7.64	1	6.36	1	7.53	1
7/24/2000	8.39	1	8.41	1	18.99	1
8/28/2000						
9/25/2000						
10/25/2000	9.26	1	6.56	1	16.18	1
4/24/2001	10.02	1	8.4	1	14.2	1
5/22/2001	6.13	1	7.12	1	8.59	1
6/25/2001	6.95	1	7.94	1	12.96	1
7/30/2001	5.89	1	5.81	1	10.47	1
8/27/2001	6.19	1	7.01	1	11.6	1
9/24/2001	7.19	1	6.82	1	6.55	1
10/22/2001	10.42	1	10.06	1	7.05	1
4/8/2002	11.05	1	11.74	1		
5/30/2002	7.93	1	7.62	1		
6/25/2002	6.37	1	5.52	1		
7/30/2002	6.97	1	4.77	1		
8/21/2002	6.82	1	6.46	1		
9/25/2002	6.82	1	7.44	1		
10/29/2002	10.46	1	11.58	1		

Date	MCHD Sampling Locations					
	Ruth Drive DO mg/L	% Compliance	Howland at Crittenden DO mg/L	% Compliance	Broad Ripple Park Ramp DO mg/L	% Compliance
4/24/2000	8.43	1	9.45	1	8.34	1
5/22/2000	7.9	1	5.58	1	7.57	1
6/26/2000	6	1	7.17	1	6.31	1
7/24/2000	8.32	1	4.77	1	8.15	1
8/28/2000						
9/25/2000						
10/25/2000	8.05	1	8.1	1	7.85	1
4/24/2001	9.13	1	7.07	1	9.2	1
5/22/2001	6.24	1	5.81	1	6.71	1
6/25/2001	7.27	1	8.25	1	7.5	1
7/30/2001			3.94	0	5.94	1
8/27/2001	5.9	1	5.18	1	5.81	1
9/24/2001	6.74	1	4.95	1	6.95	1
10/22/2001	8.15	1	9.77	1	8.29	1
4/8/2002	10.69	1			10.65	1
5/30/2002	7.47	1			7.38	1
6/25/2002	5.49	1			4.65	1
7/30/2002	4.77	1			4.73	1
8/21/2002	5.96	1			5.18	1
9/25/2002	7.91	1			6.3	1
10/29/2002	11.88	1			11.39	1

Date	MCHD Sampling Locations			
	6800 Cornell Ave DO mg/L	% Compliance	Lake Indy DO mg/L	% Compliance
4/24/2000	9.78	1	9.16	1
5/22/2000	9.88	1	9.71	1
6/26/2000	7.3	1	7.19	1
7/24/2000	9.14	1	12.63	1
8/28/2000				
9/25/2000				
10/25/2000	8.93	1	9.46	1
4/24/2001	10.82	1	11.14	1
5/22/2001	7.39	1	7.35	1
6/25/2001	10.01	1	6.17	1
7/30/2001	6.68	1	5.56	1
8/27/2001	9.16	1	6.31	1
9/24/2001	7.68	1	7.39	1
10/22/2001	9.96	1	9.05	1
4/8/2002	11.1	1	11.24	1
5/30/2002	8.42	1	7.02	1
6/25/2002	5.61	1	4.49	1
7/30/2002	7.52	1	5.86	1
8/21/2002	8.35	1	8.14	1
9/25/2002	14.17	1	9.31	1
10/29/2002	12.29	1	13.4	1

MCHD Sampling Locations		
Date	New York Street DO mg/L	% Compliance
05/22/01	8.11	1
05/30/01	8.32	1
06/05/01	9.78	1
06/12/01	8.95	1
06/19/01	8	1
06/20/01	2.32	0
06/26/01	8.42	1
07/03/01	7.79	1
07/10/01	0.16	0
07/17/01	8.11	1
07/24/01	6.69	1
07/31/01	7.73	1
08/01/01	7.97	1
08/07/01	12.92	1
08/14/01	8.75	1
08/21/01	8.31	1
08/28/01	8.47	1
09/05/01	7.73	1
09/11/01	8.46	1
09/18/01	5.8	1
09/25/01	9.58	1
09/26/01	8.65	1
10/02/01	9.49	1
10/09/01	7.39	1
10/16/01	12.4	1
10/23/01	8.48	1
10/30/01	10.74	1
11/06/01	10.54	1
11/13/01	9.39	1
11/20/01	10.33	1
11/26/01	10.69	1
11/28/01	10.19	1
12/03/01	10.61	1
12/06/01	9.46	1
12/11/01		
12/17/01	12.79	1
12/19/01	11.62	1
01/08/02	15.29	1
01/14/02	12.11	1
01/16/02		
01/22/02	16.2	1
01/29/02	9.38	1
02/05/02		
02/11/02		
02/13/02		
02/18/02		
02/26/02	10.16	1
03/05/02	14.95	1

MCHD Sampling Locations		
Date	New York Street	%
	DO mg/L	Compliance
03/11/02	12.71	1
03/13/02	11.03	1
03/19/02	12.91	1
03/25/02	16.3	1
04/02/02	13.41	1
04/08/02	9.76	1
04/10/02	11.48	1
04/16/02		
04/30/02	9.17	1
05/06/02	10	1
05/13/02	9.78	1
05/20/02	9.24	1
05/22/02	9.49	1
05/29/02	8.65	1
06/04/02	7.91	1
06/11/02	7.3	1
06/13/02	6.35	1
06/18/02	7.67	1
06/25/02	7.46	1
07/03/02	5.51	1
07/09/02	6.8	1
07/16/02	8.56	1
07/23/02	5.95	1
07/31/02	6.2	1
08/07/02	11.67	1
08/15/02	8.45	1
08/20/02	7.45	1
08/27/02	6.81	1
08/29/02	8.2	1
09/03/02		
09/10/02	8.09	1
09/17/02	6.89	1
09/24/02	7.4	1
09/25/02	6.98	1
10/02/02	7.11	1
10/08/02	8.09	1
10/10/02	7.72	1
10/23/02	9.79	1
10/30/02	9.57	1
11/05/02	11.92	1
11/12/02	8.58	1
11/18/02	11.83	1
11/20/02	12.58	1
11/25/02	11.61	1

IDEM Sampling Locations								
Date	Raymond Street DO (mg/L)	% Compliance	Date	Waverly (SR 144) DO (mg/L)	% Compliance	Date	86th Street DO (mg/L)	% Compliance
3/21/2001	13.08	1	1/6/2000	9.5	1	1/11/2000	10.5	1
4/18/2001	10.96	1	2/3/2000	12.1	1	2/10/2000	12.6	1
4/25/2001	10.56	1	3/23/2000	10.4	1	3/2/2000	10.8	1
5/2/2001	10.82	1	4/7/2000	8.8	1	4/20/2000	9.3	1
5/9/2001	9.35	1	5/23/2000	7.6	1	5/8/2000	6.5	1
5/15/2001	13.23	1	6/13/2000	9.86	1	6/13/2000	5.29	1
5/23/2001	8.49	1	7/7/2000	6.5	1	7/20/2000	7.4	1
5/30/2001	9.04	1	8/2/2000	9.5	1	8/9/2000	7	1
6/4/2001	9.04	1	9/7/2000	6.5	1	9/7/2000	7.4	1
6/13/2001	8.48	1	10/12/2000	7.8	1	10/26/2000	6.7	1
6/20/2001	7.43	1	11/3/2000	6.7	1	11/30/2000	11.9	1
6/27/2001	10.66	1	12/20/2000	11.8	1	12/20/2000	13.2	1
7/5/2001	5.04	1	1/18/2001	13.2	1	1/25/2001	12.7	1
7/11/2001	8.17	1	2/19/2001	13	1	2/28/2001	11.8	1
7/18/2001	9.07	1	3/6/2001	10.9	1	3/21/2001	14.24	1
			4/5/2001	12.4	1	3/22/2001	13.2	1
			5/16/2001	10.3	1	4/18/2001	10.7	1
			6/19/2001	8.8	1	4/25/2001	9.55	1
			7/3/2001	6.2	1	4/26/2001	11	1
			8/7/2001	10.2	1	5/2/2001	9.88	1
			9/13/2001	7.2	1	5/9/2001	7.98	1
			10/3/2001	8.4	1	5/15/2001	7.76	1
			11/21/2001	8.9	1	5/23/2001	7.68	1
			12/6/2001	9	1	5/30/2001	8.22	1
						5/31/2001	8.6	1
						6/4/2001	8.46	1
						6/13/2001	7.95	1
						6/14/2001	7.67	1
						6/20/2001	6.68	1
						6/27/2001	9.2	1
						7/5/2001	794	1
						7/11/2001	6.5	1
						7/18/2001	7.5	1
						7/26/2001	6.2	1
						8/21/2001	7.6	1
						9/11/2001	6.8	1
						10/4/2001	8.3	1
						11/1/2001	9.2	1
						12/11/2001	11.3	1

Daily Summaries of OES Continuous DO Monitoring								
16th Street			IPL Dam			Waverly (SR144)		
Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)
7/9/2001	6.62	1	6/28/2001	12.92	1	6/27/2001	9.19	1
7/10/2001	6.54	1	6/29/2001	13.65	1	6/28/2001	8.54	1
7/11/2001	6.32	1	6/30/2001	14.01	1	6/29/2001	8.72	1
7/12/2001	5.87	1	7/1/2001	10.19	1	6/30/2001	9.43	1
7/13/2001	6.35	1	7/2/2001	6.64	1	7/1/2001	8.14	1
7/14/2001	7.21	1	7/3/2001	6.85	1	7/2/2001	NA	NA
7/15/2001	8.18	1	7/4/2001	7.52	1	7/3/2001	NA	NA
7/16/2001	11.79	1	7/5/2001	8.74	1	7/4/2001	NA	NA
7/17/2001	11.91	1	7/6/2001	8.90	1	7/5/2001	NA	NA
7/18/2001	12.01	1	7/7/2001	8.72	1	7/6/2001	8.70	1
7/19/2001	7.62	1	7/8/2001	8.01	1	7/7/2001	7.45	1
7/20/2001	5.51	1	7/9/2001	7.69	1	7/8/2001	6.93	1
7/21/2001	5.10	1	7/10/2001	7.64	1	7/9/2001	6.35	1
7/22/2001	5.01	1	7/11/2001	7.38	1	7/10/2001	7.25	1
7/23/2001	5.82	1	7/12/2001	7.36	1	7/11/2001	7.11	1
7/24/2001	7.98	1	7/13/2001	7.44	1	7/12/2001	6.63	1
7/25/2001	6.96	1	7/14/2001	7.95	1	7/13/2001	7.93	1
7/26/2001	5.77	1	7/15/2001	8.94	1	7/14/2001	7.71	1
7/27/2001	6.50	1	7/16/2001	9.85	1	7/15/2001	7.93	1
7/28/2001	6.13	1	7/17/2001	9.86	1	7/16/2001	NA	NA
7/29/2001	5.58	1	7/18/2001	7.81	1	7/17/2001	NA	NA
7/30/2001	5.22	1	7/19/2001	7.14	1	7/18/2001	7.59	1
7/31/2001	5.66	1	7/20/2001	6.80	1	7/19/2001	6.68	1
8/1/2001	5.00	1	7/21/2001	6.64	1	7/20/2001	6.66	1
8/2/2001	5.48	1	7/22/2001	6.30	1	7/21/2001	6.28	1
8/3/2001	5.52	1	7/23/2001	6.64	1	7/22/2001	5.32	1
8/4/2001	6.69	1	7/24/2001	6.64	1	7/23/2001	5.65	1
8/5/2001	7.93	1	7/25/2001	6.56	1	7/24/2001	5.42	1
8/6/2001	9.33	1	7/26/2001	5.92	1	7/25/2001	5.35	1
8/7/2001	9.54	1	7/27/2001	6.58	1	7/26/2001	5.21	1
8/8/2001	11.89	1	7/28/2001	6.58	1	7/27/2001	5.84	1
8/9/2001	13.14	1	7/29/2001	6.76	1	7/28/2001	5.39	1
8/10/2001	10.50	1	7/30/2001	7.31	1	7/29/2001	5.41	1
8/11/2001	8.05	1	7/31/2001	7.06	1	7/30/2001	5.39	1
8/12/2001	7.75	1	8/1/2001	6.83	1	7/31/2001	8.28	1
8/13/2001	8.49	1	8/2/2001	6.61	1	8/1/2001	7.15	1
8/14/2001	9.59	1	8/3/2001	6.61	1	8/2/2001	6.61	1
8/15/2001	10.21	1	8/4/2001	7.42	1	8/3/2001	6.97	1
8/16/2001	8.46	1	8/5/2001	8.50	1	8/4/2001	7.41	1
8/17/2001	6.38	1	8/6/2001	9.36	1	8/5/2001	7.99	1
8/18/2001	5.78	1	8/7/2001	9.56	1	8/6/2001	8.54	1
8/19/2001	5.65	1	8/8/2001	9.61	1	8/7/2001	8.89	1
8/20/2001	5.59	1	8/9/2001	9.79	1	8/8/2001	8.87	1
8/21/2001	6.58	1	8/10/2001	8.93	1	8/9/2001	7.63	1
8/22/2001	7.32	1	8/11/2001	8.48	1	8/10/2001	7.16	1
8/23/2001	6.75	1	8/12/2001	8.91	1	8/11/2001	6.62	1
8/24/2001	5.94	1	8/13/2001	10.74	1	8/12/2001	6.83	1
8/25/2001	6.02	1	8/14/2001	11.36	1	8/13/2001	7.72	1
8/26/2001	5.89	1	8/15/2001	9.96	1	8/14/2001	6.98	1
8/27/2001	6.18	1	8/16/2001	7.52	1	8/15/2001	NA	NA
8/28/2001	6.25	1	8/17/2001	7.80	1	8/16/2001	NA	NA
8/29/2001	6.35	1	8/18/2001	8.83	1	8/17/2001	NA	NA
8/30/2001	6.75	1	8/19/2001	8.32	1	8/18/2001	NA	NA
8/31/2001	6.26	1	8/20/2001	8.09	1	8/19/2001	7.09	1
9/1/2001	6.07	1	8/21/2001	7.84	1	8/20/2001	7.84	1
9/2/2001	6.25	1	8/22/2001	7.85	1	8/21/2001	8.02	1
9/3/2001	6.61	1	8/23/2001	6.11	1	8/22/2001	7.74	1
9/4/2001	7.11	1	8/24/2001	7.11	1	8/23/2001	5.97	1
9/5/2001	7.67	1	8/25/2001	7.15	1	8/24/2001	5.65	1
9/6/2001	8.28	1	8/26/2001	6.89	1	8/25/2001	6.50	1

Daily Summaries of OES Continuous DO Monitoring								
16th Street			IPL Dam			Waverly (SR144)		
Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)
9/7/2001	9.47	1	8/27/2001	7.27	1	8/26/2001	5.28	1
9/8/2001	7.65	1	8/28/2001	7.68	1	8/27/2001	6.20	1
9/9/2001	6.22	1	8/29/2001	8.07	1	8/28/2001	6.57	1
9/10/2001	6.71	1	8/30/2001	8.29	1	8/29/2001	6.44	1
9/11/2001	7.14	1	8/31/2001	6.73	1	8/30/2001	6.31	1
9/12/2001	7.17	1	9/1/2001	6.63	1	8/31/2001	5.95	1
9/13/2001	6.79	1	9/2/2001	7.75	1	9/1/2001	5.87	1
9/14/2001	6.86	1	9/3/2001	8.73	1	9/2/2001	7.02	1
9/15/2001	7.12	1	9/4/2001	9.16	1	9/3/2001	7.37	1
9/16/2001	7.24	1	9/5/2001	9.35	1	9/4/2001	7.15	1
9/17/2001	7.34	1	9/6/2001	9.64	1	9/5/2001	5.82	1
9/18/2001	7.62	1	9/7/2001	10.09	1	9/6/2001	NA	NA
9/19/2001	7.48	1	9/8/2001	7.19	1	9/7/2001	7.46	1
9/20/2001	7.64	1	9/9/2001	6.87	1	9/8/2001	5.59	1
9/21/2001	7.74	1	9/10/2001	7.00	1	9/9/2001	5.57	1
9/22/2001	7.71	1	9/11/2001	NA	NA	9/10/2001	4.88	0
9/23/2001	7.58	1	9/12/2001	NA	NA	9/11/2001	4.84	0
9/24/2001	7.70	1	9/13/2001	NA	NA	9/12/2001	6.52	1
9/25/2001	8.17	1	9/14/2001	8.42	1	9/13/2001	7.05	1
9/26/2001	8.56	1	9/15/2001	8.79	1	9/14/2001	7.42	1
9/27/2001	8.79	1	9/16/2001	9.20	1	9/15/2001	7.84	1
9/28/2001	8.81	1	9/17/2001	9.45	1	9/16/2001	7.89	1
9/29/2001	8.99	1	9/18/2001	9.28	1	9/17/2001	8.10	1
9/30/2001	9.07	1	9/19/2001	7.93	1	9/18/2001	7.80	1
10/1/2001	9.12	1	9/20/2001	8.89	1	9/19/2001	6.61	1
10/2/2001	9.20	1	9/21/2001	9.15	1	9/20/2001	6.57	1
10/3/2001	9.01	1	9/22/2001	9.21	1	9/21/2001	NA	NA
10/4/2001	8.88	1	9/23/2001	9.01	1	9/22/2001	NA	NA
10/5/2001	8.38	1	9/24/2001	8.82	1	9/23/2001	NA	NA
10/6/2001	8.74	1	9/25/2001	NA	NA	9/24/2001	10.50	1
10/7/2001	9.26	1	9/26/2001	8.84	1	9/25/2001	NA	NA
10/8/2001	9.47	1	9/27/2001	8.70	1	9/26/2001	8.28	1
10/9/2001	9.55	1	9/28/2001	8.69	1	9/27/2001	8.01	1
10/10/2001	9.19	1	9/29/2001	8.80	1	9/28/2001	7.93	1
10/11/2001	8.76	1	9/30/2001	8.74	1	9/29/2001	7.83	1
10/12/2001	8.75	1	10/1/2001	8.67	1	9/30/2001	NA	NA
10/13/2001	8.59	1	10/2/2001	8.56	1	10/1/2001	NA	NA
10/14/2001	8.50	1	10/3/2001	9.50	1	10/2/2001	NA	NA
10/15/2001	8.92	1	10/4/2001	9.94	1	10/3/2001	NA	NA
10/16/2001	9.27	1	10/5/2001	8.79	1	10/4/2001	NA	NA
10/17/2001	9.91	1	10/6/2001	9.26	1	10/5/2001	6.61	1
10/18/2001	10.17	1	10/7/2001	9.69	1	10/6/2001	6.93	1
10/19/2001	9.92	1	10/8/2001	9.09	1	10/7/2001	8.32	1
10/20/2001	9.67	1	10/9/2001	8.32	1	10/8/2001	8.54	1
10/21/2001	9.29	1	10/10/2001	8.42	1	10/9/2001	9.04	1
10/22/2001	8.84	1	10/11/2001	8.17	1	10/10/2001	9.00	1
10/23/2001	8.25	1	10/12/2001	1.00	0	10/11/2001	8.00	1
10/24/2001	8.68	1	10/13/2001	8.56	1	10/12/2001	7.97	1
10/25/2001	9.00	1	10/14/2001	8.43	1	10/13/2001	8.64	1
10/26/2001	9.19	1	10/15/2001	8.85	1	10/14/2001	8.13	1
10/27/2001	9.63	1	10/16/2001	9.12	1	10/15/2001	8.61	1
10/28/2001	9.70	1	10/17/2001	9.56	1	10/16/2001	8.96	1
10/29/2001	9.36	1	10/18/2001	9.84	1	10/17/2001	9.78	1
10/30/2001	9.27	1	10/19/2001	9.62	1	10/18/2001	10.44	1
10/31/2001	9.58	1	10/20/2001	9.35	1	10/19/2001	10.15	1
11/1/2001	9.33	1	10/21/2001	9.08	1	10/20/2001	9.85	1
11/2/2001	9.01	1	10/22/2001	8.85	1	10/21/2001	9.57	1
11/3/2001	9.10	1	10/23/2001	8.38	1	10/22/2001	9.22	1
11/4/2001	9.33	1	10/24/2001	8.88	1	10/23/2001	8.74	1
11/5/2001	9.49	1	10/25/2001	10.11	1	10/24/2001	8.41	1
11/6/2001	9.92	1	10/26/2001	10.81	1	10/25/2001	8.50	1

Daily Summaries of OES Continuous DO Monitoring								
16th Street			IPL Dam			Waverly (SR144)		
Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)	Date	Average Daily DO	% Compliance (5 mg/L)
11/7/2001	10.14	1	10/27/2001	11.71	1	10/26/2001	9.24	1
11/8/2001	10.12	1	10/28/2001	11.88	1	10/27/2001	10.15	1
11/9/2001	10.15	1	10/29/2001	11.77	1	10/28/2001	10.38	1
11/10/2001	10.32	1	10/30/2001	11.65	1	10/29/2001	10.32	1
11/11/2001	10.45	1	10/31/2001	11.46	1	10/30/2001	9.94	1
11/12/2001	10.74	1	11/1/2001	11.29	1	10/31/2001	9.57	1
11/13/2001	10.76	1	11/2/2001	11.04	1	11/1/2001	9.25	1
11/14/2001	10.62	1	11/3/2001	11.32	1	11/2/2001	8.82	1
11/15/2001	10.58	1	11/4/2001	11.54	1	11/3/2001	8.91	1
11/16/2001	10.42	1	11/5/2001	11.76	1	11/4/2001	9.13	1
11/17/2001	10.26	1	11/6/2001	11.97	1	11/5/2001	9.22	1
11/18/2001	10.18	1	11/7/2001	12.13	1	11/6/2001	9.28	1
11/19/2001	9.98	1	11/8/2001	12.23	1	11/7/2001	9.29	1
11/20/2001	10.05	1	11/9/2001	11.50	1	11/8/2001	9.19	1
11/21/2001	11.03	1	11/10/2001	10.86	1	11/9/2001	9.36	1
11/22/2001	11.62	1	11/11/2001	11.12	1	11/10/2001	9.37	1
11/23/2001	12.01	1	11/12/2001	11.27	1	11/11/2001	9.57	1
11/24/2001	11.51	1	11/13/2001	11.46	1	11/12/2001	9.61	1
11/25/2001	10.52	1	11/14/2001	11.56	1	11/13/2001	9.52	1
11/26/2001	10.80	1	11/15/2001	12.06	1	11/14/2001	9.41	1
11/27/2001	10.77	1	11/16/2001	12.25	1	11/15/2001	9.54	1
11/28/2001	10.48	1	11/17/2001	8.27	1	11/16/2001	9.63	1
11/29/2001	10.41	1				11/17/2001	9.56	1
11/30/2001	10.42	1				11/18/2001	9.64	1
12/1/2001	10.70	1				11/19/2001	10.09	1
12/2/2001	10.96	1				11/20/2001	11.86	1
12/3/2001	11.13	1				11/21/2001	11.24	1
12/4/2001	10.96	1				11/22/2001	10.37	1
12/5/2001	10.66	1				11/23/2001	10.34	1
12/6/2001	10.29	1				11/24/2001	9.73	1
12/7/2001	11.27	1				11/25/2001	9.43	1
12/8/2001	12.00	1				11/26/2001	10.11	1
12/9/2001	12.65	1				11/27/2001	10.14	1
12/10/2001	13.38	1				11/28/2001	10.33	1
12/11/2001	12.69	1				11/29/2001	10.17	1
12/12/2001	11.87	1				11/30/2001	10.16	1
12/13/2001	11.48	1				12/1/2001	11.25	1
12/14/2001	11.12	1				12/2/2001	11.38	1
12/15/2001	11.08	1				12/3/2001	11.21	1
12/16/2001	11.20	1				12/4/2001	10.72	1
12/17/2001	11.02	1				12/5/2001	10.24	1
12/18/2001	10.77	1				12/6/2001	9.95	1
						12/7/2001	9.96	1
						12/8/2001	9.89	1
						12/9/2001	10.28	1
						12/10/2001	10.51	1
						12/11/2001	10.54	1
						12/12/2001	10.56	1
						12/13/2001	10.15	1

Date	Wet or Dry Data?	OES Sampling Locations					
		82nd Street		Morris Street		Harding Street	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
1/5/2000	Wet	522	0	9454	0	3636	0
2/2/2000	Dry	200	1	10	1	27	1
3/1/2000	Wet	280	0	108	1	36	1
4/5/2000	Wet	34	1	10	1	13	1
5/3/2000	Wet	131	1	1900	0	7500	0
6/7/2000	Dry	133	1	220	1	328	0
7/5/2000	Wet	1700	0	20000	0	9909	0
8/9/2000	Wet	1200	0	1800	0	2000	0
9/6/2000	Dry	360	0	1000	0	1909	0
10/4/2000	Wet	200	1	1803	0	380	0
11/1/2000	Dry	51	1	56	1	5	1
12/6/2000	Dry	371	0	48	1	68	1
1/15/2001	Wet	900	0	193	1	35	1
2/12/2001	Dry	640	0	600	0	400	0
3/6/2001	Dry	220	1	95	1	50	1
4/4/2001	Dry	76	1	7	1	7	1
5/2/2001	Dry	19	1	10	1	5	1
6/13/2001	Dry	127	1	62	1	100	1
7/11/2001	Wet	2200	0	480	0	620	0
8/8/2001	Dry	13	1	62	1	25	1
9/5/2001	Dry	5	1	100	1	86	1
10/3/2001	Dry	46	1	92	1	80	1
11/7/2001	Dry	17	1	24	1	35	1
12/4/2001	Dry	176	1	210	1	135	1

Date	Wet or Dry Data?	OES Sampling Locations					
		Tibbs/Banta		Southwestway Pk		Waverly (SR 144)	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
1/5/2000	Wet	6091	0	4800	0	6000	0
2/2/2000	Dry	1900	0	5000	0	5000	0
3/1/2000	Wet	100	1	130	1	315	0
4/5/2000	Wet	273	0	9	1	27	1
5/3/2000	Wet	800	0	1600	0	3300	0
6/7/2000	Dry	454	0	66	1	443	0
7/5/2000	Wet	65000	0	77000	0	7000	0
8/9/2000	Wet	1967	0	3600	0	2000	0
9/6/2000	Dry	2600	0	1639	0	2545	0
10/4/2000	Wet	900	0	1167	0	1700	0
11/1/2000	Dry	72	1	360	0	240	0
12/6/2000	Dry	1070	0	2560	0	2020	0
1/15/2001	Wet	2350	0	400	0	3650	0
2/12/2001	Dry	1500	0	1100	0	2250	0
3/6/2001	Dry	488	0	560	0	688	0
4/4/2001	Dry	8	1	72	1	10	1
5/2/2001	Dry	14	1	43	1	29	1
6/13/2001	Dry	67	1	100	1	57	1
7/11/2001	Wet	1050	0	1067	0	1300	0
8/8/2001	Dry	360	0	2350	0	260	0
9/5/2001	Dry	290	0	230	1	350	0
10/3/2001	Dry	72	1	120	1	152	1
11/7/2001	Dry	400	0	270	0	320	0
12/4/2001	Dry	133	1	220	1	187	1

Date	Wet or Dry Data?	OES Sampling Locations	
		30th Street	
		E. Coli (col/100 mL)	% Compliance
1/5/2000	Wet	200	1
2/2/2000	Dry		
3/1/2000	Wet	30	1
4/5/2000	Wet	12	1
5/3/2000	Wet	100	1
6/7/2000	Dry	300	0
7/5/2000	Wet	980	0
8/9/2000	Wet	600	0
9/6/2000	Dry	400	0
10/4/2000	Wet	400	0
11/1/2000	Dry	42	1
12/6/2000	Dry	255	0
1/15/2001	Wet	233	1
2/12/2001	Dry	1033	0
3/6/2001	Dry	104	1
4/4/2001	Dry	19	1
5/2/2001	Dry	33	1
6/13/2001	Dry	48	1
7/11/2001	Wet	540	0
8/8/2001	Dry	20	1
9/5/2001	Dry	14	1
10/3/2001	Dry	22	1
11/7/2001	Dry	60	1
12/4/2001	Dry	140	1

Date	Wet or Dry Data?	MCHD Sampling Locations							
		Raymond Street		96th Street		Marina Drive		Ruth Drive	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
4/24/2000	Wet	200	1	100	1	50	1	200	1
5/22/2000	Wet	310	0	110	1	60	1	220	1
6/26/2000	Wet	440	0	220	1	590	0	20	1
7/24/2000	Dry	60	1	10	1	10	1	20	1
8/28/2000	Dry	50	1	90	1	10	1	70	1
9/25/2000	Wet	970	0	100	1	11300	0	4960	0
10/25/2000	Wet	200	1	100	1	100	1	100	1
4/24/2001	Wet	100	1	100	1	100	1	100	1
5/22/2001	Wet	520	0	410	0	100	1	1200	0
6/25/2001	Dry	520	0	520	0	100	1	310	0
7/30/2001	Wet	1200	0	2850	0	2030	0	740	0
8/27/2001	Wet	740	0	200	1	100	1	100	1
9/24/2001	Wet	7980	0	2330	0	100	1	1750	0
10/22/2001	Dry	100	1	410	0	100	1	730	0
4/8/2002	Wet	209	1	63	1			63	
5/30/2002	Wet	683	0	213	1			780	
6/25/2002	Wet	4106	0	108	1			335	
7/30/2002	Wet	7701	0	131	1			63	
8/21/2002	Wet	2613	0	158	1			689	
9/25/2002	Dry	545	0	143	1			2187	
10/29/2002	Wet	41	1	52	1			432	

Date	Wet or Dry Data?	MCHD Sampling Locations					
		Broad Ripple Park Ramp		6800 Cornell Ave		Lake Indy	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
4/24/2000	Wet	500	0	200	1	1000	0
5/22/2000	Wet	140	1	390	0	220	1
6/26/2000	Wet	50	1	620	0	230	1
7/24/2000	Dry	10	1	10	1	10	1
8/28/2000	Dry	10	1	20	1	100	1
9/25/2000	Wet	100	1	5650	0	970	0
10/25/2000	Wet	100	1	100	1	410	0
4/24/2001	Wet	100	1	100	1	100	1
5/22/2001	Wet	410	0	520	0	630	0
6/25/2001	Dry	200	1	100	1	1690	0
7/30/2001	Wet	100	1	1750	0	2110	0
8/27/2001	Wet	200	1	100	1	200	1
9/24/2001	Wet	740	0	1710	0	1750	0
10/22/2001	Dry	200	1	100	1	100	1
4/8/2002	Wet	62		197		187	
5/30/2002	Wet	148		85		546	
6/25/2002	Wet	50		141		2987	
7/30/2002	Wet	10		175		146	
8/21/2002	Wet	132		98		218	
9/25/2002	Dry	41		31		86	
10/29/2002	Wet	10		10		345	

MCHD Sampling Locations			
Date	Wet or Dry Data?	New York Street	
		E. Coli (col/100 mL)	% Compliance
05/22/01	Wet	200	1
05/30/01	Wet	310	0
06/05/01	Wet	410	0
06/12/01	Dry	410	0
06/19/01	Dry	200	1
06/20/01	Wet	1480	0
06/26/01	Dry	100	1
07/03/01	Wet	860	0
07/10/01	Wet	850	0
07/17/01	Dry	100	1
07/24/01	Wet	310	0
07/31/01	Dry	300	0
08/01/01	Dry	310	0
08/07/01	Dry	100	1
08/14/01	Dry	100	1
08/21/01	Wet	860	0
08/28/01	Dry	510	0
09/05/01	Dry	410	0
09/11/01	Wet	520	0
09/18/01	Wet	9880	0
09/25/01	Wet	1460	0
09/26/01	Dry	410	0
10/02/01	Dry	100	1
10/09/01	Dry	300	0
10/16/01	Wet	1460	0
10/23/01	Dry	100	1
10/30/01	Dry	410	0
11/06/01	Dry	100	1
11/13/01	Dry	100	1
11/20/01	Wet	200	1
11/26/01	Wet	970	0
11/28/01	Wet	840	0
12/03/01	Dry	1530	0
12/06/01	Wet	200	1
12/11/01	Dry	100	1
12/17/01	Wet	9580	0
12/19/01	Wet	2400	0
01/08/02	Dry	100	1
01/14/02	Dry	100	1
01/16/02	Dry	100	1
01/22/02	Dry	100	1
01/29/02	Dry	100	1
02/05/02	Dry	630	0
02/11/02	Wet	520	0
02/13/02	Wet	100	1
02/18/02	Dry	100	1

MCHD Sampling Locations			
Date	Wet or Dry Data?	New York Street	
		E. Coli (col/100 mL)	% Compliance
02/26/02	Wet	8500	0
03/05/02	Wet	1280	0
03/11/02	Wet	1100	0
03/13/02	Wet	200	1
03/19/02	Wet	200	1
03/25/02	Wet	11530	0
04/02/02	Dry	683	0
04/08/02	Wet	169	1
04/10/02	Wet	295	0
04/16/02	Wet	1565	0
04/30/02	Wet	3448	0
05/06/02	Wet	24195	0
05/13/02	Wet	10462.4	0
05/20/02	Wet	240	0
05/22/02	Wet	121	1
05/29/02	Wet	295	0
06/04/02	Dry	96	1
06/11/02	Dry	50	1
06/13/02	Wet	272	0
06/18/02	Wet	160	1
06/25/02	Wet	1334	0
07/03/02	Dry	109	1
07/09/02	Wet	158	1
07/16/02	Dry	41	1
07/23/02	Wet	131	1
07/31/02	Wet	259	0
08/07/02	Dry	41	1
08/15/02	Wet	63	1
08/20/02	Wet	4106	0
08/27/02	Dry	148	1
08/29/02	Dry	52	1
09/03/02	Dry	98	1
09/10/02	Dry	20	1
09/17/02	Wet	318	0
09/24/02	Wet	413	0
09/25/02	Dry	187	1
10/02/02	Dry	97	1
10/08/02	Dry	301	0
10/10/02	Dry	145	1
10/23/02	Dry	86	1
10/30/02	Wet	2755	0
11/05/02	Wet	109	1
11/12/02	Wet	1565	0
11/18/02	Wet	98	1
11/20/02	Wet	20	1
11/25/02	Dry	31	1

IDEM Sampling Sites					
Date	Wet or Dry Data?	86th Street		Waverly (SR 144)	
		E. Coli (col/100 mL)	% Compliance	E. Coli (col/100 mL)	% Compliance
1/11/2000	Wet	490	0	2200	0
2/10/2000	Wet	260	0		
3/2/2000	Wet	150	1	2000	0
4/20/2000	Wet	70	1	78	1
5/8/2000	Wet	58	1	690	0
6/13/2000	Wet	65	1		
7/20/2000	Wet	77	1	1100	0
8/9/2000	Wet	430	0	1200 (QJ)	0
9/7/2000	Dry	25 (QJ)	1	690 (QJ)	0
10/26/2000	Dry	20	1		
11/30/2000	Dry	98	1	1100	0
12/20/2000	Wet	1600	0	1700	0